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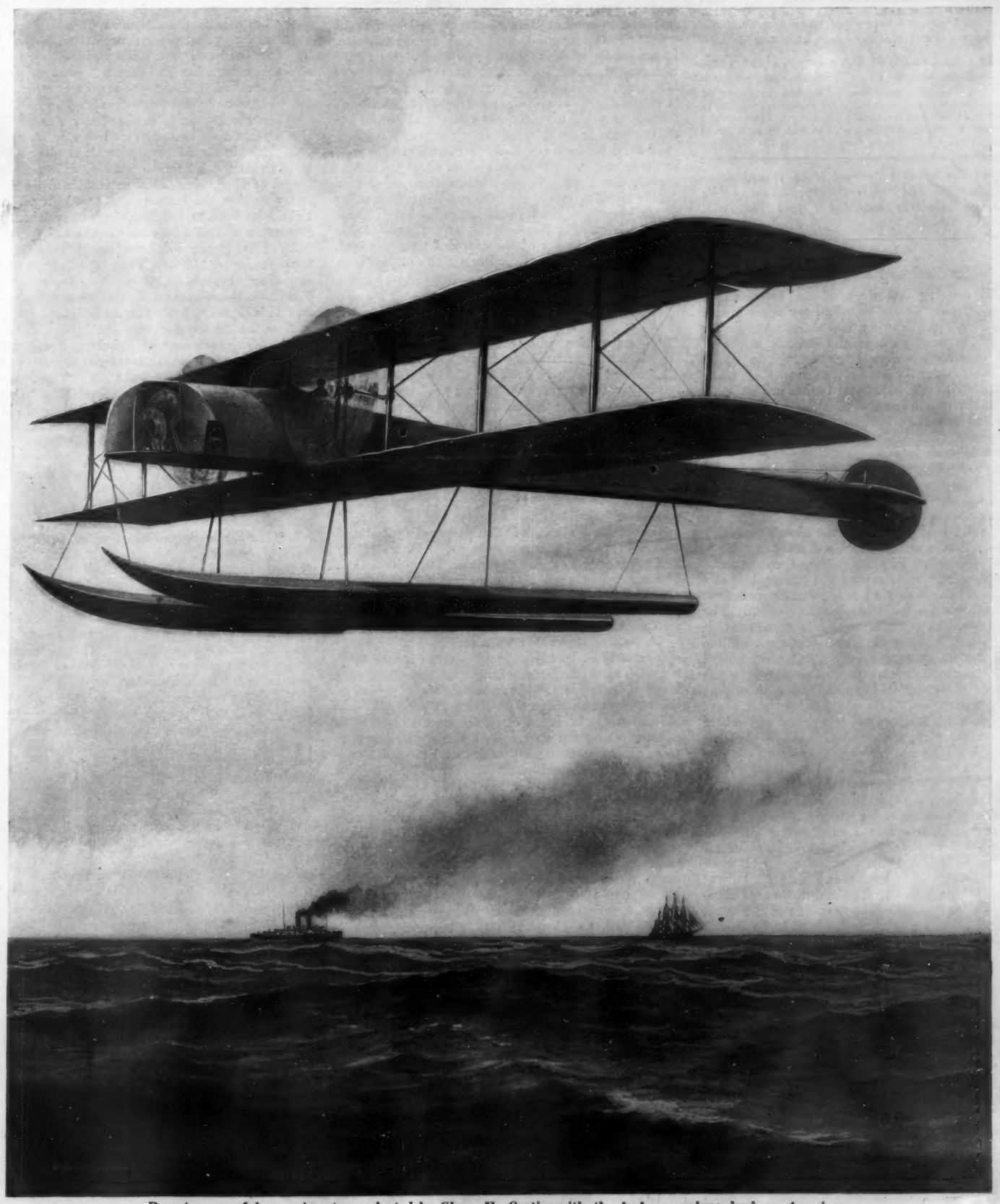

Recent successful experiments conducted by Glenn H. Curtiss with the hydro-aeroplane lead an American aviator, Mr. James V. Martin, to believe that the ocean can be crossed at its narrowest part by a flying-boat.

CAN THE ATLANTIC OCEAN BE CROSSED IN AN AEROPLANE?—[See page 106.]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

By Railroad to Key West

THE opening last week of the extension of the Florida East Coast Railway from Miami to Key West, Florida, marked the completion of one of the most arduous and difficult works of railroad construction ever attempted. The island of Key West forms the southern extremity of a line of swamp land, coral islands and more or less shallow channels, which reaches from Miami for a distance of 156 miles to the island of Key West. The importance of Key West is two-fold. Lying only ninety miles from Havana, it is destined to form an important shipping point for the transfer of freight and passengers from rail to ship; and, considered from the strategic standpoint, its station forms one of the most important elements in the sea coast and naval defenses of the United States.

Several years ago the Florida East Coast Railway Company ordered its engineering corps to make a thorough survey to determine the practicability of building a single-track road along the Florida Keys from Miami on the main land to Key West. The survey was made and the engineers reported that the line could be built at a cost of fifteen million dollars, or at an average cost of about one hundred and fifty thousand dollars per mile—a rate which far exceeds the cost for any similar length of line hitherto constructed. Of this total length about seventy-five miles are located over water and a considerable portion lies over the sea itself.

A summary of the successive sections of the line shows what a variety of conditions were encountered. The first thirty miles south of Miami presented no serious difficulties, the line being built on the mainland. The following nineteen miles were built through a heavy mangrove swamp, which afforded insufficient water to float dredges and no material that could be reached by wheelbarrow and work cart for building an embankment. Two dredges of shallow draft were built, which dug their own channels, one on each side of the center line of the track, and unloaded the materials to form an embankment lying between them. The line was carried across thirty islands, the intervening stretches of water being covered either by rock fills or by building reinforced-concrete arch viaducts. In some cases the water over which these viaducts were built ranged in depth from ten to thirty feet. The most important viaduct, reaching from Long Key to Conch Key, is ten thousand five hundred feet in length. Two other viaducts are, respectively, seven thousand three hundred and seven thousand eight hundred feet long, and the fourth across Bahia Honda channel is just under five thousand feet long. In crossing the wider channels much of the work had to be performed by floating plants on which the concrete was mixed, and from which it was placed in position by boom derricks. Where possible, the pier foundations were placed by means of open cofferdams; in other cases, where the water was deeper, it was necessary to sink caissons.

As is frequently the case in railroad construction, one of the principal difficulties was that of getting men and supplies to the site, and maintaining constant communications with the base on the main land. As an instance of the difficulties encountered, it may be mentioned that the water for the men and for the many steam plants had to be transported in tanks for more than one hundred miles. In the open sea stretches of work the construction forces were exposed to the sudden storms which break with little warning in those localities; nd it sometimes happened that the floating plants would be scattered before they had time to withdraw to shelter. Considering the difficulties of the work, however, the casualties have been surprisingly small.

Included in the original scheme was a plan for building extensive blocks and terminals at Key West, and the institution of an ocean-going ferry service to transport cars directly to and from Havana. The scheme includes, also, the construction of a large dry dock and ten piers each eight hundred feet long by one hundred feet in width, with a depth of water ranging from twenty feet to forty feet available, sufficient to accommodate any shipping from small coasting steamers up to vessels of the largest size. In connection with the matter of communication with Havana, it is of interest to note that last year McCurdy, the aviator, essayed to fly from Key West to Havana, and actually arrived within ten miles of the Cuban port, when he was forced to descend because of motor trouble.

If the Florida Keys Railway extension proves to be the important railway connection which promoters expect, the time will come when the question of double tracking must be considered—an undertaking which, because of the transportation facilities afforded by the existing line—would be far less formidable, both in respect of the cost and time required, than the construction of the line which has just been opened.

A Timely Warning

IN connection with the widespread discussion which was aroused by the failure of the Austin concrete dam we note that a word of warning has recently been uttered by a former professor of civil engineering at the Montana State College. Writing to the *Engineering Record*, Mr. E. T. Tannatt suggests that a contributory cause to the failure of some concrete dams which have given way may have been the destructive effect of alkali that was present in the water. The writer refers to a bulletin published during his stay at the college, in which he called public attention to the harmful action of the alkali of the soil upon Portland cement. Although his warning was ridiculed by many prominent cement experts and engineers, Mr. Tannatt reminds us that after three years' study and research, this destructive action was clearly proved, and that the government has verified his statement in various bulletins and papers.

The writer states that while engaged in the study of this subject he investigated a considerable number of concrete failures, among which was that of a large concrete dam. Examination of a portion of the structure which remained intact showed every indication of the action of alkali for a considerable distance along the dam. With the naked hand he was able to remove what had once been solid concrete to a depth and width of over a foot, and he was able to do this for several feet horizontally along the face of the dam. As the result of his examination of numerous failures of concrete structures he was led to the conclusions, first, that where seepage, capillary action and evaporation can unite to produce a concentrated alkaline solution in concrete, the cement will be destroyed, even if the percentage of alkali carried by the impounded water is very small indeed. When a stream contains alkali, or when the soil is impregnated with alkali, any seepage through the dam will carry alkali in solution to the downstream side, which is exposed to the air. Here evaporation will increase the strength of the alkali solution, and there will be maximum destructive action at that point. Secondly, in cases where it is not possible to remove this saturated solution as it accumulates, we may look for very rapid disintegration of the concrete. Thirdly, when in the construction of a dam there is faulty joining of successive layers of concrete, the water seeping through the dam will tend to follow these natural lines of cleavage, and destructive action from the alkali may be looked for.

During his investigation at the Montana State College, Mr. Tannatt found that sandstone is subject to alkali action. Prisms of sandstone from the same sample were placed in vessels, some of which were filled with distilled water, and others with an alkaline solution, and the samples in the latter showed marked evidence of disintegration. Flasks of Portland cement which had been subjected to the action of alkali by partial immersion showed also the disintegrating effect of alkali. Again, in the case of a concrete arch which failed because of the destruction of the concrete close to the water line, it was shown that although the construction was less than three years old, the presence of alkali in the water was responsible for the failure.

The investigations of the government in the arid lands of the West, where alkali is abundant, have proved that it is destructive to Portland cement; and although this agent may have had no serious part in the failure of the Austin and other concrete dams, we agree with Mr. Tannatt that the engineering profession at large should thoroughly investigate this matter and make every provision for its prevention or control, in localities where its action may be looked for.

The Light of the Piddock

THE stone-boring piddock (*Pholas dactylus*) has a luminous siphon or breathing tube. In order to find out the mechanism by which the light is produced, Raphael Dubois carried on a series of interesting and thoroughgoing experiments on the coast of Brittany, the results of which he has just presented to the Paris Academy of Sciences.

When the siphon is mechanically stimulated, the liquid exuded is luminous; and this property is retained by the liquid even after it is thoroughly filtered to remove all solid particles. After a variable length of time, which may be shortened by shaking, or by raising the temperature to 95 deg.-104 deg. Fahr., the light is permanently extinguished. This non-luminous liquid he calls "liquid A."

By raising the luminous liquid rapidly to the temperature of 158 deg. Fahr. the light is also extinguished; but the liquid resulting from this operation has properties quite distinct from those of liquid A. This liquid he calls "liquid B."

Now, on mixing the two liquids, the light reappears. On examining all the data, it appears that liquid A contains an active ferment of the nature of a peroxydase—that is, an oxydizing ferment. This is shown by the fact that liquid B can be made again luminous by the addition of hydrogen peroxide in certain proportions, or by potassium permanganate. This ferment can be separated from the liquor by means of neutral calcium chloride; or it may be prepared from fresh piddocks by a special process of extraction.

The essential principle in liquid B has all the general characteristics of an albuminoid. It coagulates near the boiling point of water, and completely loses the power of producing light when it is boiled. It becomes luminous directly when oxidation begins, but it does not oxidize directly in the air. When liquid B is allowed to decompose there appears a large amount of phosphoric acid; this fact and certain other reactions point to the conclusion that the substance is a nucleo-albumin. This is further confirmed by the appearance of the cells of the luminous glands under the microscope.

To this nucleo-albumin Dubois gives the name *luciferine*. It is a very unstable compound; it is precipitated by picric acid with immediate decomposition. If the precipitate is gathered on a filter, and quickly thrown into a large quantity of water, the addition of a small amount of potassium permanganate will result in a glow. The filtrate, on the other hand, cannot be made to emit light.

The action of the oxydizing ferment may be suspended by dehydration, and its power preserved for a long time. Thus a number of siphons were removed from the piddocks, drained off and buried in powdered sugar. A month later they were again placed in water, and a liquid with the normal luminosity was obtained.

Chemical examination has revealed the presence of luciferine in a large number of non-luminous marine animals, as well as in the body proper of the piddock, which never glows. A closely related piddock (*Pholas candida*) which is not luminous, also bears this albuminoid in its blood. On extracting the luciferine from various animals, it may be made to glow either by the addition of some chemical oxidizing agent, or by the blood of the razor clam, the hard-shell clam, the oyster and other common non-luminous molluscs. The luciferine is thus found to be a delicate indicator for the presence of a peroxydase, the distribution of which is widespread among all classes of organisms.

All mechanical, physical and chemical agents which retard, suspend, suppress or increase the photogenic action of the luminous liquid obtained from the piddock, produce corresponding effects in all other cases in which physiological light is produced by plants or animals. Dr. Dubois therefore concludes that physiological light is the result of indirect oxidation of an albuminoid, luciferine, by a peroxydase ferment, luciferase.

Electricity

Flame-arc Headlights.—One of the recent innovations on interurban electric cars is the use of metallic-flame-arc headlights in place of the ordinary carbon-arc lamps. These lamps are used on direct current circuits of 120 volts and over. They use four amperes at about 70 volts at the arc. They give a brighter and more penetrating light for the same expenditure of energy than has been obtainable heretofore with incandescent lamps and carbon-arc lights.

The First Electric Installation in a Mine.—It was brought out at the recent meeting of the Association of Mining and Electrical Engineers at Glasgow that the first colliery to use electric light was that at Earnock, in the Hamilton District, in 1879. The electric lighting system was installed at the suggestion of Lord Kelvin. A Gramme machine was used, with a capacity for lighting 30 lamps. This experiment proved so successful that three other dynamos were later installed, each generating current enough to supply 60 lamps.

The Illumination of St. Patrick's Cathedral.—The illumination of St. Patrick's Cathedral, on the occasion of the return of Cardinal Farley to New York, called for the use of 27,000 8-candle-power lamps to outline the building. The wire used in this connection amounted to about twenty miles. Aside from the effect, which was certainly remarkably beautiful, the actual work involved in wiring the tall spires of the cathedral was notable for the fact that it had to be pushed day and night in order to bring it to completion within the required time. Furthermore, the weather was excessively cold. In order to keep the steeplejacks warm they were provided with electric heating pads.

Battery Locomotives for Chicago Railroad Terminals.—At his recent visit to Chicago, Mr. Thomas A. Edison made a study of railroad conditions in Chicago's large terminal yards. Owing to public agitation against the smoke nuisance, these yards will have to be electrified before long. Mr. Edison gave it as his opinion that the simplest solution of the problem will be to use storage battery locomotives, as they would not require the use of any overhead system or the installation of a third rail. The tenders of the locomotives could carry the storage batteries. The locomotive would then be independent power units and could be operated like ordinary steam locomotives. The only objection to such a system would be that it would take some time to charge the batteries. According to a recent report, however, Mr. Edison has improved his storage battery in this respect so that now the charging can be done in a comparatively short time.

Electricity in Cold Weather.—In a recent issue of *The Electrical World*, the advantages of electricity in cold weather were outlined. It was stated that in Chicago during the first week of January the gas companies received 7,000 calls per day to thaw out frozen pipes. This kept 600 trained men at work. In the meantime electric service, so far from being hampered by the cold, actually operated to better advantage owing to the better insulation afforded. Those who had depended on gas for cooking purposes found that it was necessary for them to make use of their electrically-heated utensils, one man using an electric flatiron as an emergency stove for cooking eggs. This he did by inverting the flat iron and using its polished under surface for a stove top. Another resourceful individual used his flat iron to thaw out a frozen radiator, while still another householder, in order to make his radiator more efficient and stir up the stagnant air in the room, used an electric fan on the floor to direct a stream of air against the radiator pipes. He found that by this simple method the temperature of the room was raised 25 degrees in a half hour.

Novel Electric Alarm for Clocks.—The method of putting an electric contact upon the dial of an alarm clock in order to ring a bell when the hands come to the right point is well known, as is also the method of wrapping a cord about the winding key so as to have it pull a switch. However, all these cases imply modifying the clock in one way or another. What is desired is not to make any change whatever upon the clock, and this is realized in a vibration method used by a French inventor. All that is needed is to put the clock on a shelf or the cover of a box, the shelf having a main flat part for the clock and in front a sloping part or slideway. On the slideway a metal bar is laid and below it are two contacts such as screws or nails, so that when the alarm goes off the vibration of the shelf will cause the bar to slide down and make the contact. An alternative scheme is to pivot the bar at one end, with a contact stud lying below the other end. In this case one wire is connected to the bar and the other to the stud, so that the bar swings down and makes contact. The battery and electric bell can be placed inside the box, and the top is used for the shelf. An electric lamp above the clock completes the outfit.

Science

Exploration of the San Blas Coast.—The dangerous task of exploring the San Blas coast of the Isthmus of Panama—a region hitherto inaccessible to white men on account of the hostility of the San Blas Indians—has been undertaken by Dr. H. Pittier, who has recently been making a thorough biological survey of the better known parts of the Isthmus for the Smithsonian Institution. The explorer is reported to have already won the friendship of the chief of the village of Nargara, who has permitted him to visit that place.

Excessive Dampness in Rooms.—A room may be too damp for human occupancy without showing the growth of molds or mildews, or the formation of crystals upon the walls. In order to test the habitability of a room with respect to humidity, *Le Journal de la Santé* recommends placing about two pounds of freshly slaked lime in the room, sealing up all doors and windows tightly, and leaving for twenty-four hours. If the increase in weight during this time (absorption of water) exceeds ten per cent of the weight of the lime, the room should not be considered healthful.

Eucalyptus Oil.—Great improvement has been made in recent years in the extraction and purification of oil from the eucalyptus or "blue gum" tree. A number of distinct oils have been isolated that can be used as substitutes for oil of violet, citronella and attar of roses. On account of these improvements there has been adopted the standard of the British Pharmacopœa of 50 per cent Eucalyptol for all oils sold under the name. As a consequence vast quantities of lower grade oils became unavailable and literally a drug on the market. Through the efforts of experts employed by the Technical Museum of Sydney, however, it has been found that these low grade oils could be utilized in the recovery of metals from low grade "tailings" at the mines. The concentrates can be economically worked now by the use of about half a pound of "phellandrene" oil to the ton of concentrates.

A Plague of Snails.—The region about Bernwala in Ceylon was afflicted with a veritable plague of snails. These animals (*Achatina fulica*), although they are extraordinarily prolific, do not frequently appear in sufficiently large numbers to make themselves obnoxious. Their danger does not appear at first either, because they feed upon animal excrements and other filth; but when they have exhausted this source of nutrition they attack the young plants, eating leaves, bark and fruits. It is extremely difficult to exterminate them; the natives dig trenches to stop their progress. They have few natural enemies, among them being a common mud turtle and an ant, *Phidelogeton affinis*, which destroys the eggs. One method used for protecting the trees is to surround each tree with a ring of cork or fiber impregnated with tar or pitch. This is efficacious, though it involves a great deal of work.

An Expedition Across Greenland—The Swiss Society of Naturalists is raising funds to enable the well-known geophysicist and meteorologist, Dr. A. de Quervain, to undertake a journey across the inland ice of Greenland, from Disco Bay, on the west coast, to Angmagsalik, the only inhabited place on the east coast. The expedition expects to leave Europe on the steamer "Hans Egede," April 1st, 1912, and to start eastward from Disco Bay the middle of June. It is expected that four weeks will be required for the journey, but provisions for twice that time will be carried. Two members of the expedition are to remain on the west coast of Greenland until the spring of 1913, to carry on glaciological and aerological studies—the latter in connection with similar observations that are to be made at the same time on the east coast of Greenland, in Iceland and in Spitzbergen.

A Remedy Against the Cochylis.—The vineyards in many parts of France have this year suffered considerable damage from a new insect pest, a small moth of the genus *Cochylis*. The larvæ cause the grapes to drop from the stalk. Each grape in an infected plant will have one or two larvæ in it, but the number may reach as high as eight or even more. Many methods have been tried in an attempt to exterminate them, but with very little success. Dr. A. de Varene has found that a mixture of four parts of benzine or crude oil (petroleum) to one part of poppy-oil is sure death to the insects. He applied the mixture from a dropping flask, placing a drop in each infected grape—which can be readily recognized by its appearance. This method would seem to be very tedious and expensive, but it is an improvement upon the best hitherto found, namely, the picking off of each caterpillar by the fingers, or with a pair of pincers. Although the vines that have been attacked this year cannot be saved by this application, it is important to destroy the larvæ as far as possible, in order to avoid a recurrence of the pest when the next generation hatches out. As science has practically succeeded in destroying the obstinate *Phyloxera* insect success against the present pest may be apprehended.

Engineering

Superheated Steam Locomotives.—Once a practicable form of superheater had been evolved, the growth in popularity of the locomotive using superheated steam was inevitable. Had the compound locomotive not made such a bold bid for popularity, superheat would have come into its own many years ago. The latest notable engine of this type is a Pennsylvania Railroad Mallet, a simple superheater with four 27-inch by 28-inch cylinders and a boiler pressure of 160 pounds.

Testing Foundations Under the Mississippi River Dam.—The quality of the rock below the big dam across the Mississippi River at Keokuk is tested by drilling holes at 36-foot intervals, which are sunk 36 feet in the rock. Air at 100 pounds to the square inch pressure is applied at each bore hole, and in the adjacent holes are gages which show whether air has leaked into them from the hole at which pressure is applied. If there is evidence of flow, the excavation is carried down until sufficiently solid rock bottom is obtained.

Freight Tunnel Under the Hudson.—The construction of a freight tunnel under the Hudson River, to be built by New York and New Jersey, is proposed by Dock Commissioner Tomkins, as part of a plan for the comprehensive development of the port of New York. It is suggested that the rates be fixed by the Interstate Commerce Commission, as it is believed that this arrangement would abolish terminal competition. Some years ago a freight tunnel was proposed as part of a shore-line tunnel extending around the lower part of Manhattan Island, both the Manhattan and the Hudson River Tunnels to be connected with an assembling and distributing station in New York.

Exploitation of the "Maine" Wreck.—All people who have the dignity of the nation at heart will be gratified to know that the "Maine" is not to be exploited by the professional showman. The government will see to it that such guns, shells and other memorials of the ship as may be given away are used as memorials only. The mainmast will be set up at Arlington Cemetery. The other mast will probably go to the Cuban Republic for erection in Havana as a memorial to the "Maine." The hull itself will be floated out to deep water and sunk with ceremonies appropriate to mark the end of a fighting ship.

A Question of Cylinder Capacity.—The question of the introduction of the internal combustion engine as the motive power on ocean-going vessels is to-day mainly one of cylinder capacity. The larger the individual cylinder can be made for satisfactory service, the sooner will the heavy-oil engine be adopted as the drive for battleships and transatlantic liners. At present marine engines are being built in Europe which will develop 1,000 horse-power per cylinder. A single cylinder engine to develop 1,200 brake horse-power, and another with a single cylinder to develop 2,000 horse-power are being constructed. A 6,000-horse-power, three-cylinder engine is being built for the German navy. In all of the above engines cylinder diameters run from 32 to 40 inches, the stroke is about 40 inches, and the revolutions are 150 per minute, or less.

Peat for Fuel Uses.—Different methods of employing peat as fuel or power are used at present, one of these being to fire the furnace with dried peat briquettes, and another is to distill the peat in the same way as for coal so as to produce gas. The gas is then used directly in gas engines of suitable construction. According to a new Swedish method, the dried peat is first brought to a fine powder and is then blown into the furnace by an air fan. The furnace has been previously heated, and waste heat can be utilized here. The firing is then kept up by the peat delivered in this way. It is claimed that 15 parts of peat give the same heat as 10 parts of coal. During the firing it is easy to regulate the heat to the right amount by adjusting the air feed, as well as the powder supply. Inasmuch as no more fuel is burned than is needed, and the regulation can be made very quickly, good economy is secured.

A New Type of Oil Engine.—A new German type of oil engine is built to run with liquid tar as fuel, and is said to work very successfully. One of the large gas companies had the engine designed by the Körting establishment in order to see whether such tar coming from coal distillation could not be used to operate an engine. The present engine is built for 100 horse-power and was tested by coupling with a dynamo. Starting and heating up in the first place are done by the use of paraffine oil. The engine was run on a 66-hour endurance test, carrying a two-thirds load, and after the trial it was found that the valves and the other parts were very clean and there was no deposit such as might be feared inside the engine. A very regular running was also one of the good points observed. Following this successful test, there are to be built engines of much larger size which are to give 600 horse-power. It is found that the full value of the tar comes not far below that of paraffine oil for the same weight.

Mapping the Value of Gravitational Force

International Scientific Team-work

By L. William Thavis

THE United States government has recently entered into an agreement with several European countries for the purpose of determining or measuring the force of gravity in the countries interested; in addition it is extending its own investigations in America.

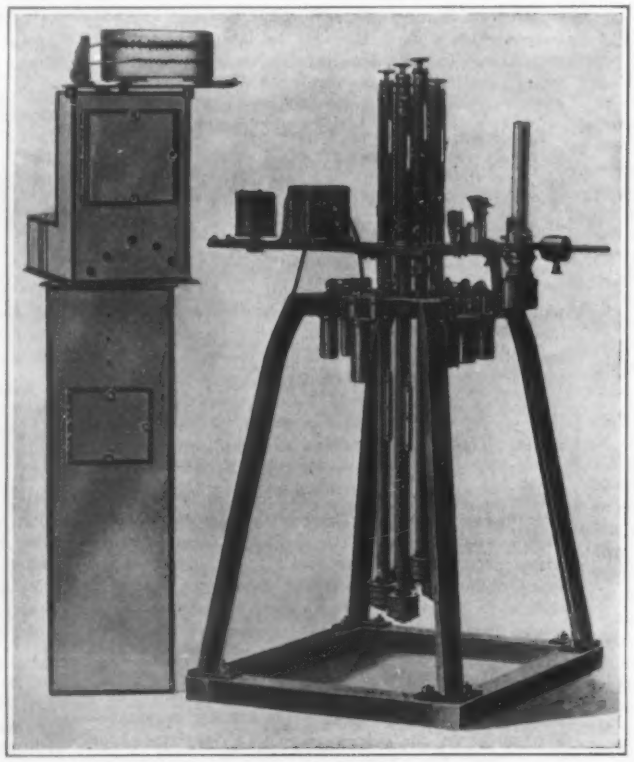
Gravity is the force which causes bodies to fall toward the earth or a pendulum to swing. Its intensity may be measured by the velocity attained by a falling body at the end of a second, or by the number of swings that a pendulum of definite length will make in a definite time. The latter method of measurement is capable of very great accuracy and is used for all observations of the intensity of gravity on land. In order that the determinations may attain the desired precision and yet be carried out within a reasonable time, a highly specialized apparatus is used.

That employed by the United States Coast and Geodetic Survey, which first began the study of gravity in 1850, is the invention of two of its physicists, Drs. Mendenhall and Fischer. Preliminary experiments have been made with this apparatus at the station in Washington, D. C., and the experiments are now being extended to the other ninety-two stations which the Survey conducts in this country. Most of these stations are located near the 39th parallel of latitude, from Washington to San Francisco.

In the apparatus used by the Survey a set of invariable pendulums is swung in an air-tight case in a partial vacuum, at a uniform temperature. An electrical flash apparatus makes the half second beats of a chronometer visible and permits the observer to note when the beat coincides with a swing of the pendulum. The time of oscillation of the pendulum at the station where the intensity of gravity is to be ascertained is compared with the time of oscillation under identical conditions at a station at which the intensity is known. The value of g, the acceleration due to gravity, is then calculated. Latitude and altitude both affect the distance from the earth's center and gravity varies inversely as the square of that distance. Hence observations are reduced to sea level and are then compared with the normal value of gravity for the latitude for the observation according to a formula worked out by the German geologist Helmert.

In the use of the pendulum the question of support must be considered. It is a foregone conclusion that no pendulum support is entirely rigid; even though it weigh several tons and extend into the depths of the earth. It is therefore necessary to determine the amount of the movement of the pendulum support before an accurate conclusion can be reached regarding the force of gravity. This is done by means of an extremely delicate apparatus, the interferometer, which measures distances in terms of wave lengths of light.

To make this movement as slight as possible the pendulum receiver at the Geodetic Survey at Washington is mounted on a solid cement pier whose foundation of rock extends down into the ground about six feet, and the feet of the box-like receiver are screwed down or weighted securely with buckets of sand or bricks. So delicate and sensitive are the instruments used in these investigations that it is frequently found advisable to defer experiments for a time on account of traffic in the near-by streets or the rumble of the machinery in adjacent buildings. Even the vibrations caused by the wind pressure against the buildings is a disturbing factor. The line of gravity stations maintained by the United States commences at the Atlantic coast, rises to near the crest of the Appalachian ridge, traverses the great central plain, increasing in altitude gradually to the high elevation of the main chain of the Rocky Mountains, where the highest altitude is reached at Pike's Peak. It then descends into the valleys of the Grand and Green rivers, crosses the summit of the Wasatch ridge and finally descends to the great western plateau of the continent.



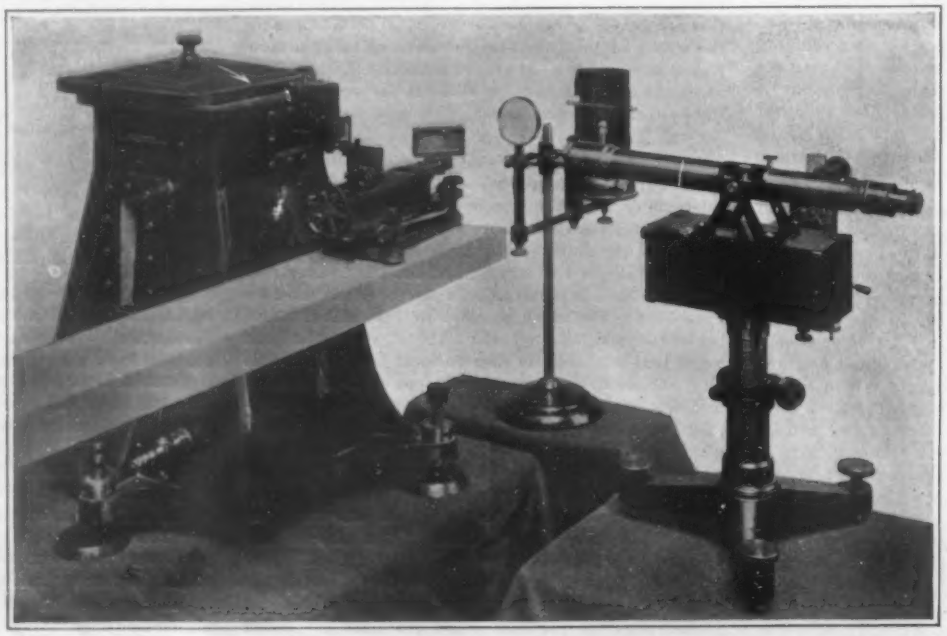
Hecker's apparatus for measuring gravity at sea.

Stations were established in the Yellowstone Park because there only in the United States (exclusive of Alaska) may still be found signs of volcanic activity. The summit of Pike's Peak was occupied because of its altitude and because of the advantages of comparing results of observations there with those obtained at Colorado Springs near the base of the mountain, which are of value in determining the density of the earth. It is hoped that by the extended series of determinations of g much will be learned regarding the structure of the earth's crust.

As it is impossible to observe a pendulum on board ship, measurements of gravity in ocean areas were restricted to oceanic islands until recently, when they were made possible on the water by a method in which the pressure of air as shown by a barometer is compared with the pressure of the air as determined by the boiling point of water.

In measuring the air pressure with a barometer the air is balanced by the column of mercury, which will be somewhat shorter at a place where the intensity of gravity is high than at a point where the intensity is less. If the air pressure be measured by observing the boiling point of water, the result is independent of any gravitational influence upon the apparatus. By using both methods at a station the effect of gravity on the barometer at that station can be ascertained, and by comparing the effect obtained at various stations, relative intensities are found.

This method, which was originally invented by the German physicist Mohn, was adapted to oceanic work by Dr. E. O. Hecker, who devised an elaborate apparatus for the purpose. Five mercurial barometers are hung in a metal plate swung on gimbals, which are so illuminated that the movements of the upper surface of the mercury are registered on a photographic film. The record is a wavy line, since the barometers are constantly agitated by the motion of the ship, but with the aid of a special apparatus which registers that motion, the effect on the barometer and their actual reading can be ascertained.



Gravity survey pendulum apparatus with interferometer mounted for observing flexure.

MAPPING THE VALUE OF GRAVITATIONAL FORCE

The Effect of the Panama Canal on Steamship Routes

A FORECAST of the changes likely to be effected in existing steamship routes by the opening of the Panama Canal forms the subject of a recent article in *Hansa*.

Steamers proceeding from Europe to San Francisco will take the canal route, thus saving 6,200 sea miles, as compared with the route via Cape Horn. Steamers from Montreal to Sydney will also use the canal, saving 2,738 sea miles.

It is uncertain whether freighters from Europe to Valparaiso will take the canal route, which would save only 2,100 miles; but passenger ships will doubtless prefer the shorter route, and will serve the east coast of South America by means of auxiliary ships sailing from West Indian ports.

Between Europe and Japan the route via Suez will still be preferred, as at present, since the Panama route would be 1,000 miles longer; but between New York and Shanghai the Panama route will be chosen, thus saving 1,400 sea miles. Between Europe and Australia the present route is only 800 miles longer than will be that via Panama; possibly not enough to cause the abandonment of the former.

Aside from the consideration of distance, the journey via Panama obviates the usually rough and stormy rounding of Cape Horn, and this fact will considerably affect the passenger routes.

Steps are already being taken to prepare for the redistribution of the coal trade that will result from the changes of route above referred to. English firms are reported to be arranging to open coaling stations at Nukulofa, the capital of the Friendly Islands, and on Pitcairn Island.

Semi-steel Cars in Railroad Wrecks

Lessons from a Rear Collision in the West

THE recent rear collision in which four prominent railroad officials, including an ex-president of the Illinois Railroad, wefe killed in a private car, will have a beneficial effect in directing attention to this too frequent and very fatal form of train wreck.

Let it not be supposed that the views of another rear collision shown on this page are to be taken as evidence that the steel car is no safer than the ordinary wooden car. As a matter of fact they rather prove how great is the resisting power of the new steel construction. Bad as the wreck looks, we believe it would have been very much worse had the train which was run into been entirely of wooden construction. The telescoping would probably have extended beyond the two rear cars of the train. The scene of this wreck was Odessa, Minn., and the circumstances are like those of a hundred other altogether preventable collisions which have occurred in the history of American railroads. Carelessness and neglect of rules of operation seem to have largely contributed to the disaster.

An express train on the Chicago, Milwaukee and Puget Sound Railroad, when running east bound, was blocked at a small way station. Following behind it was a fast silk train, also east bound. The flagman was sent back and should have gone a distance of over twenty telegraph poles, and placed torpedoes on the rails. Whatever was done, the silk train, consisting of a locomotive and seven cars, failed to stop and crashed into the rear of the train ahead. The rear car of the "Columbian" was a steel sleeper; ahead of it was a steel dining car. According to the report of the members of the State Railway Commission, these two cars did not represent the most up-to-date form of steel construction, and although the trains were termed all-steel construction, they were not really so. According to the report, "the under framing of these particular cars is made up of two rolled steel girders, which extend between the trucks only, and are joined to the end of the car with cast steel combined body bolster and platform. The platform and bolster frame broke into pieces from the shock of the collision, while the rolled steel girders were uninjured. Although steel car construction is still in the experimental state, it appears that it is necessary to have rolled steel girders extend clear through to the buffers, and that it is unwise to combine cast steel with rolled steel and expect the casting to uphold its portion of the responsibility. The casting on the sleeper was shattered to pieces and its broken parts exposed to view defective metal.

"The body of the sleeping car has steel sides of ⅛-inch plate. There were no steel uprights nor cross bracings used, and the interior finish of the car consisted of wood and paper. Apparently too great reliance was placed upon the steel plate side. Had the rolled steel girders extended through to the buffers, the chances are that the car would not have telescoped and the attendant loss of life might have been averted.

"As constructed, this type of car probably is no safer than the modern wooden sleeping car, and does not meet with the public idea of modern steel equipment."

Although we scarcely agree with the report of the Commission when it states that these cars are probably no safer than the modern wooden sleeping car, we do believe that the failure to continue the longitudinal steel girders right up to the buffers was a fatal error, and went far to destroy the additional safety which steel construction should have insured.

Telescoping is due to the mounting of one platform above the other. The superior platform acts as a knife, and driven by the enormous momentum of the colliding trains, shears cleanly through the car ahead. By extending the longitudinal members, particularly those at the center of the car, entirely from bumper to bumper, and by providing specially designed and very powerful couplings at the abutting bumpers, it should be possible to all but absolutely preclude the mounting of one platform above the other. The Pennsylvania Railroad Company have adopted this plan, and in their new cars the longitudinal stresses of coupling, hauling, and collision are received and taken care of in a big, very stiff and strong box girder, which runs from bumper to bumper and constitutes the main support of the floor framing. In such collisions as have already occurred the cars were held together at the couplings sufficiently firmly to prevent telescoping. The cars of such trains will either rear together into the air or buckle sideways at the couplings.

Rear of train, showing locomotive buried in the last sleeper.

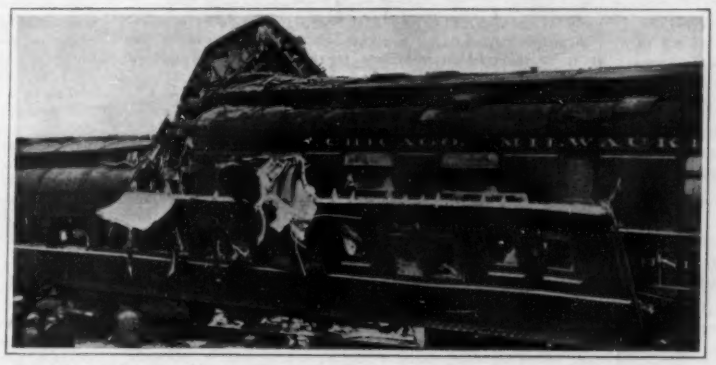


Photo by L. Radke, Bellingham, Minn.

This shows the dining car after it had sheared halfway through the rear sleeper.

SEMI-STEEL CARS IN RAILROAD WRECKS

The Chestnut Bark Disease

FOR several years there has been growing the rumor that "before very long" all the chestnut trees in the eastern parts of the United States will be dead. And those of us who have had but a casual opportunity to see chestnut trees within from thirty to a hundred miles of New York city must have noticed that these beautiful plants were dead or dying rapidly. The Bureau of Plant Industry of the Department of Agriculture has set some of its experts at work on the cause of the disease, the method of infection, the agencies for the spread of infection, and the best methods for prevention and cure; but in advance of publication of this report, the department has issued a "Farmers' Bulletin," giving the most important points for general information.

The disease is believed to have been introduced into this country with some Japanese chestnut trees brought to Long Island, and was first noticed in 1904. Since then it has killed practically all the trees in and about New York city, and most of those in the neighboring counties. The damage thus done has been estimated conservatively at $25,000,000; and as the infected area extends in all directions, the damage each year is increased. It seems that only trees of the true chestnut group are susceptible—the genus *Castanea;* this includes the American chestnut, the chinkapin or "dwarf chestnut," and the cultivated European varieties. Other related species seem to be immune.

The cause of the disease is a fungus that has been named *Diaporthe parasitica* by Dr. Murrill of the New York Botanical Garden. This fungus produces two kinds of spores, a summer spore which comes out in long yellow threads during damp weather; and a winter spore which is found in tiny reddish-brown pustules that break out on the surface of the bark. The infection is probably carried by insects, by rodents, such as squirrels and chipmunks, and by various birds, especially woodpeckers. Other means by which the spores have been transported are tan bark and diseased timbers and nursery stock carried from infected regions.

It has been supposed by many owners of chestnut trees, and by other observers, that the development of the disease is in some way related to "reduced vitality." The evidence on hand would indicate that there is no such relation, unless the reduced vitality is caused by, or accompanied by, holes or breaks in the bark. For it is through such holes that the fungus grows toward the deeper layers from the point of infection. It has been found, for example, that the borings of certain insects are especially liable to serve as a passage way for the fungus, since these borings are always moist, even in dry weather.

No method has been found for dealing in a practical way with infected trees in a forest. In isolated cases, however, the disease may be checked if discovered early and proper precautions are taken. Since the disease has advanced very largely by infecting isolated spots at considerable distances from the main line of the infected region, the method recommended may serve eventually to stamp out the disease. The chief difficulties are of a legal nature.

To test the method, experiments were carried on in the region about Washington, D. C. By thorough "scouting," every infected tree in a territory is located; this must be done by men who are thoroughly trained to recognize the symptoms of the disease, which are rather obscure even for the ordinary nurseryman or forester. The attacked trees are marked, and later cut down. Since the wood is not affected, this may be used, but it is important that all the bark be removed and burned, together with the brush, over the stump. This will destroy the fungus growth and the spores. When the advance line has been established, the scouting is directed back toward the main body of the infected region, and a zone of from ten to twenty miles is planned, in which all trees are to be destroyed. In this way there will be established a barrier confining the disease to the region in which the trees cannot be saved, and preventing its spread to new areas. The State Legislature of Pennsylvania was the first to take official cognizance of the damage the disease is doing, and has made an appropriation that will enable a special commission to attack the problem in an effective manner, since it provides for the destruction of privately owned trees, where necessary, with reimbursement of the owner. It also provides for imprisonment and fine for all persons, "natural or artificial," who wilfully violate the regulations of the commission or otherwise interfere with its operations.

In addition to the work of establishing an "immune zone," the report recommends quarantine and inspection of nursery stock and of bark and timber that may scatter the infection. Individual trees in orchards or about houses may be treated, if the disease is not too far advanced, by gouging out the diseased spots and painting the exposed area with coal tar. The owners of valuable ornamental chestnut trees are "specifically warned against 'fake' tree doctors," as no cure can be assured. Owners of chestnut woodland that has become attacked are advised to cut down the trees, burn the bark and brush and market the timber as the most economical and profitable way of meeting the situation. Growers west of the Ohio are warned against nursery stock from the east, and to inspect thoroughly stock from any source. Since the Japanese chestnut is suspected to have brought the disease into this country, it would not be advisable to import specimens of this plant, although the seed is probably safe.

A Meteorologist's Voyage Around the World

AS a preliminary to making detailed plans for the new federal meteorological service of Australia—formed by consolidating the meteorological services of all the Australian States—the commonwealth meteorologist, Mr. H. A. Hunt, was sent by his government on a tour of inspection of kindred institutions in North America, Europe, and Asia. Mr. Hunt spent about a fortnight in the United States studying the methods and equipment of the Weather Bureau. The detailed report of his journey has just been published by the Commonwealth Bureau of Meteorology (Melbourne), and gives an immense amount of interesting information regarding the principal weather services.

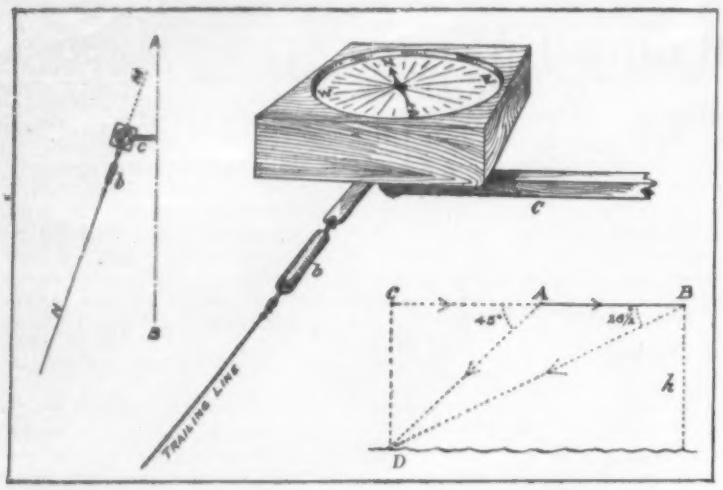


Fig. 1. The compass face swings in a horizontal plane on a pivot. The spring balance b measures tension of cord and thus indicates the speed; AB is keel of aeroplane; C is the arm carrying the pivot on which the compass swings. The angle between NM and AB measures leeway. Referring to diagram in lower right hand corner, the observations are made at A and B, AB being the path of the aeroplane. Draw DC vertical at D and AC horizontal. Evidently $AC = CD = h$ = height of aeroplane. Also $AC = h \cot 45° = h$; and $CB = h \cot 26\frac{1}{2}° = 2h$; hence $CB - CA = (2h - h) = h$. $AB = h$.

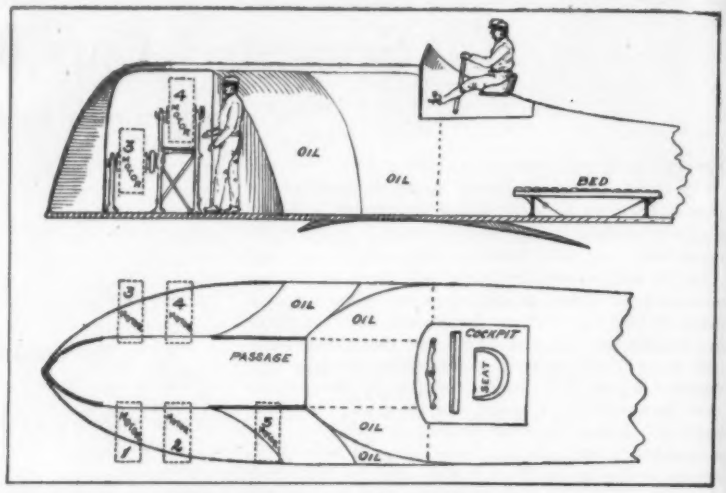


Fig. 2. Diagram of a proposed transatlantic flying machine. Five fifty-H. P. Gnome engines are geared to two tractor-screws. The load is 7,000 pounds, of which 4,500 would be fuel. Inclosed fuselage, 8 feet in width and 6 feet in height, is provided. Span of the machines, 100 feet; chord, 10 feet.

A two-foot passage is left fore and aft from the cabin to the engine room. The engines are placed on both sides of the inclosed central passage, where they are easily accessible. The craft will be of the hydro-aeroplane type and will be carried on a catamaran floatable structure, on which it will rest should it be found necessary to drop to the water.

Across the Atlantic by Aeroplane

The Problem and Suggestions for Its Solution

By James V. Martin, Master Mariner and Pilot Aviator

THERE seems to be little doubt in the minds of aviation experts that the next great conquest of the aeroplanes will be the transit of the turbulent Atlantic. Plans are now far advanced toward securing a substantial prize for the undertaking and to encourage builders to design aeroplanes for the ocean trip.

To say that the trip is a hazardous one, that it presents difficulties both unique and severe, and that aeronautical science is as yet too crude to assist the designer greatly, is merely to confess that the problem of successfully crossing the Atlantic by aeroplane has few peers in difficult engineering.

It would not be difficult to picture the meaning of the transatlantic aeroplane trip to progress in general. The shortest time of transit would in all probability be cut in half, and the fact that only a few years' development of flying machines had produced a type capable of crossing the ocean should make the "can't-be-done man" hesitate to include aeroplane transportation of light freight and passengers in his category of impossibles.

To army and navy men such a trip should, indeed, be significant. For the thousands of pounds of fuel required for the voyage, thousands of pounds of deadly explosive might be substituted. The number of hours in sustained flight is a gage of the distance that a man might travel by aeroplane to and from the enemy's most vulnerable point of attack.

Let us inquire what are the real difficulties to be met in an attempt to cross the ocean by air, and what are the suggestions of the specialists in the several fields of research concerned as to the means and possibilities of overcoming these difficulties.

We must ask a competent designer whether the science of aerodynamics is sufficiently advanced to furnish a machine, which, under favorable circumstances, would meet the conditions. Since these conditions relate especially to an over-water type of heavier-than-air machine, it is natural to seek the opinion of one who made and flew the first successful hydro-aeroplane, and one who has shown marked progress in the development of the air-water type. The writer is authorized to state that Mr. Glenn H. Curtiss believes the accomplishment of the ocean flight possible, and is prepared to design and build a special aeroplane for the trip.

We should consult a nautical expert who is also familiar with the general principles of aeronautics as to the probability of a navigating aviator's ability to locate the position of his aeroplane and direct it over the shortest route to its destination. No one is better qualified to speak on this subject than Prof. R. W. Willson of Harvard University, because of his years of application to the problems of nautical astronomy and aerial navigation. The writer has received the following opinion from him:

"Given an engine which can be absolutely relied on, a properly constructed aeroplane, and favorable weather, I see no reason why the trans-atlantic passage of less than 2,000 miles might not be successfully made.

"Assuming that the mechanical difficulties of keeping the aeroplane in motion can be successfully overcome, the navigating officer would first have to select the course to be followed. By following the ocean steamship course the chances of catastrophe in case of mishap would be materially lessened. By following the route from Newfoundland to England time would be reduced to a minimum. What compromise should be made between the two plans is the first thing to be considered. It seems to me that it would be wise to strike the line of ships as early as possible, say about longitude 40 degrees or no further east.

"The problem of navigating an aeroplane is a peculiar one. The path of a ship through the water is determined with considerable accuracy by the course and distance sailed as found by the compass and the log, while astronomical observations are used to check this 'dead reckoning' at frequent intervals unless prevented by cloud or fog. The aeroplane on the contrary may often be at a sufficient height to allow of an accurate determination of its position by observation, while a low lying fog cuts off from a ship below the sight of the horizon necessary for the usual observation of the sun's altitude.

"The difficulty with the airship is to keep an account of its speed and the direction of its motion, which is, of course, more dependent on the motion of the body of air in which it flies than the course of the ship is dependent on the ocean current in which it sails and its leeway caused by wind and sea.

"As I know of no published treatment of this problem and as all suggestions should be canvassed, I venture to put forward the following ideas, merely remarking that they should be tried on those preliminary trials of a proposed cross-ocean aeroplane which should certainly precede any well advised attempt to make the journey.

"In the first place it should be definitely ascertained whether in good weather the sea horizon is sufficiently defined for sextant observations at the height at which the passage would be made, remembering, of course, that if desirable, the height may be decreased for a time solely for the purpose of making the observations.

"On the few occasions when I have had an opportunity to study the sea horizon from heights of 2,000 to 5,000 feet in clear weather the uncertainty has been so great that I should estimate the possible error at twenty miles. Special refraction tables might be necessary at a height of a mile, but this I have not had time to consider. It is true that an uncertainty of twenty miles is of far less importance to the airman than to the seaman, and that his problem of a land fall is in some respects simpler.

"I presume that there will be no great difficulty in making observations of the altitudes of the heavenly bodies from an aeroplane if the development of the science of aviation makes it necessary.

"For determining the course and distance it would be possible to learn something at any time when the airship could be made to pass nearly over some well marked point in the water beneath—how conspicuous such objects would have to be and how frequently they would be visible on an ocean voyage you can tell better than I.

"I should think I had seen patches and streaks of smooth water and perhaps other objects easily visible at a mile or two of distance and sufficiently stationary to be used from a rapidly moving aeroplane, for the observations of a four point bearing, that is by observing the time when the object is directly beneath and again when it is left behind and depressed 45 degrees below the horizon. The distance travelled in the observed interval of time is equal to the height of the aeroplane, hence the speed may be determined while a compass bearing of the object taken at the same observation gives the course.

"Of course all the methods of using two bearings and the elapsed time which are useful at sea may be modified in a similar way, the problem being the reverse of the nautical problem, the distance of the aeroplane from the water being used to find the speed instead of the speed being used to find an unknown distance.

"It is, of course, necessary to know the height, and this requires that a reliable barometer should be carried. It has been suggested that the often unreliable aneroid be checked by finding the dip of the horizon and thus computing the height, this would be possible with a fair degree of accuracy at moderate heights and with a clear horizon by means of the 'Navigator's Prism' described by Capt. John B. Blish, Proc. U. S. Naval Inst., Vol. XXIX, p. 175.

"At night it might be possible to drop a sodium pellet of suitable size and note the time when it has been left behind so far that its depression is 45 degrees and again when its depression is 26.5 degrees. In this interval the distance traveled by the aeroplane is equal to its height above the water and the speed is thus determined. This will be evident from Fig. 1.

"It would be possible perhaps to devise some method of marking a spot on the water that would serve as a mark in the day time for such an observation. It is not impossible that the spray from breaking waves might under some conditions form suitable points for observation. If the ocean steamship routes were followed it is probable that many ships might be used for this purpose, due allowance being made for their own proper motion.

"I have considered the possibility of using a light float trailed by a fine line to indicate the direction of the aeroplane and perhaps to serve as an indicator of its speed. If the direction and force of the wind were constant at all levels from the aeroplane to the water surface, or if conditions were such that all points of the line lay in the same plane this plane would indicate pretty accurately the direction of the flight of the airship; while it is probable that conditions could be arranged so that the vertical angle at which the line left the aeroplane would give a measure of the speed. Experience would probably furnish a proper correction for the effect of cross currents between the airship and the water surface.

"It is not unlikely that only a very small float would be required and that a considerable amount of the line itself dragging through the water would furnish the necessary friction, perhaps fairly constant under various conditions of the sea. Perhaps a small patent log attached to such a line might be made to give an approximate value of the speed, or perhaps the tension of the cord as measured by a spring balance would serve to measure the speed.

"In any case it seems worth while to try all these methods in a set of preliminary experiments at various heights and under varying conditions of wind and sea. I would suggest the following construction for the log line apparatus. The line itself to consist of about two miles of salmon line weighing about one pound per mile and with a breaking strength of 22 pounds (these being figures which I have obtained from a commercial sample), and the height of the aeroplane to be maintained at about 3,000 feet during the observation. The accompanying diagram shows the form I should give to the log line apparatus."

We should inquire from a meteorologist whether a season and route may not be chosen which will greatly enhance the chances of success. Perhaps no one is better informed as to Atlantic Ocean weather conditions than the founder of the Blue Hill Observatory, Prof. A. Lawrence Rotch. His "Charts of the Atmosphere," recently published for aeronauts, show how favorable the crossing of the ocean from Newfoundland would be for a dirigible airship, and, by inference, for an aeroplane.

As to the mere operation of the aeroplane controls by the aviator, the writer is of the opinion that given a well-designed aeroplane, properly adjusted, the aviator's work is quite simple and offers no special problem beyond that of shifting control when one oper...or relieves the other.

The special difficulty in a transit of the Atlantic Ocean by aeroplane is that of sustaining the weight of oil and fuel necessary to keep the engines running during the period required for the aeroplane to travel from St. Johns, Newfoundland, to the coast of Ireland, a distance of approximately 1,800 miles. There are ex-

(Continued on page 116.)

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Cloth Hangers

To the Editor of the SCIENTIFIC AMERICAN:

Lately I have been seeing notices of several inventions made for cloth hangers, and I thought it would be of interest to your readers if I mention that about the simplest cloth hanger I have ever come across is the one used by the Indian washerman. He simply takes two ropes and twists them together, and when he desires to hang up any clothing, he slightly opens out one of the twists and places the end of the cloth into this open twist, thus securely hanging up the clothing without any injury to the cloth whatsover.

Rangoon, India. MAURICE OPPENHEIMER.

Administering Ether by the Gwathmey Method

To the Editor of the SCIENTIFIC AMERICAN:

On page 7 of the SCIENTIFIC AMERICAN of January 6th, I notice an editorial comment on the work done by Dr. Gwathmey in securing a satisfactory method for the administration of ether. I observe that you state that it has been known for several years, and I am perfectly willing to acknowledge that that is true. I have had several physicians make a similar remark to me, and say that they obviated post-anesthesia nausea. My reply has been always, "I am very glad indeed to know it, and am delighted. How do you do it? And if you do it, why have you not told the world about it, and let the world get the benefit of it?" In other words, why do the physicians pretend that they know about these things and still not put them in practice? Why do their patients continue to have sick stomachs after they have had the anesthetics? Whereas the patients who receive the anesthetic in accordance with this method are not sick. That's the whole story in a nutshell. You may use this information as you like, but I prefer for you to refer directly to the published papers either by Dr. Gwathmey or myself bearing upon the problem. CHARLES BASKERVILLE.

[The SCIENTIFIC AMERICAN'S statement was made only after consulting no less than three well-known surgeons, all of whom stated that not only was the Gwathmey-Baskerville process old, but not as good as methods of administering anesthetics more recently devised.—ED.]

Effect of Forests on Climate

To the Editor of the SCIENTIFIC AMERICAN:

Several months ago I noticed an article in the SCIENTIFIC AMERICAN on the effect of forests upon climate. It has left a rankling behind, for it had the earmarks of scientific writing, yet contained a scientific error—sophistry.

The article appeared to come from some one in the Weather Bureau, and this may account for its opposition to conservation as applied to our western forests.

The error consisted in saying, after an interesting account of the effect of the sun's rays upon the leaves of the forest, that all the heat stored up by the leaf was given out again in effecting chemical combinations at the root. What an error! Have we been taught wrong in our botany, physics, chemistry, geology?

The first (botany) teaches us that the forest stores up the heat of the sun, through the making of chlorophyl in the leaves by the sun's rays; the last (geology) teaches us that coal is stored up sunshine from the carboniferous age.

Mr. Editor, your correspondent was wrong, and I can prove it. The fire by which I am now writing was kindled by some of last year's sunshine from nearby hillside forests, and the glowing lumps of coal were once gigantic ferns in what is now the Lehigh colliery, Centralia, Pa The gas under which this letter is written was once stored up sunshine—coal or the extracted oils. The paper on which it is written was sunshine stored up in southern cotton fields or in Irish flax, and the paper on which it may be printed I saw cut by the million logs on a recent trip through the mountains of New York, Vermont, and New Hampshire.

Mr. Editor, your correspondent is wrong; forests do have an influence on climate. They cool the surrounding territory by extracting the heat of the sun's rays, storing it up for future use as wood, lignite, peat, or coal, and giving out again when consumed the 10,000 B. T. U. per pound that is stored.

Philadelphia, Pa. GEO. W. CROWLEY.

[In stating that the article referred to asserted that "all the heat stored up by the leaf was given out again in effecting chemical combinations at the root," our correspondent has not quoted the article, to which we presume he refers, correctly. In an article, "Forests and Water Supply," in our issue of May 27th, 1911, the writer says: "The heat units which reach the bottom of the snow are heat units collected by the tree leaves and carried by the descending sap to the tree roots, where they become released in effecting chemical changes in absorbing plant food from the soil, along with their water carrier." We fail to find in this or any other article the statement that *all* the heat stored up, etc.—ED.]

The Double Report in Gun Fire

To the Editor of the SCIENTIFIC AMERICAN:

The letter in your issue of January 20th describing two separate noises made by the discharge of a gun is worthy of more space, as it is a subject which is very little understood.

The phenomenon was brought up in an article by Mr. J. Bernard Walker in your issue of November 25th, in which Mr. Walker states that there were distinctly heard two separate "reports" during the firing by the battleship "North Carolina" during the recent aerial target practice.

Later, in your issue of January 20th, "Interested" writes that he has also noticed two sounds when shooting at a large bird in the air, there apparently being two reports, one coming from the gun and the other coming from the bird.

Our experiments with the Maxim silencer have developed many other interesting cases. For example: If a rifle equipped with a silencer is fired down a railroad track having telegraph poles along the side there is a distinct "crack" heard for each telegraph pole. If the rifle is fired from an open field with a tree or a clump of bushes at, say, 200 yards, there is heard a "crack" from this clump of trees. If there are several detached clumps of trees or bushes over the open field, there will be heard a "crack" for each one of them. If, instead of firing parallel with the ground, the gun is elevated and fired straight up into the air, we hear no noise at all, except the fall of the hammer and the "puff" of the gases escaping from the silencer.

The reason for this is probably as follows:

In the ordinary gun the report noise is so loud that it engulfs all other sounds, and we are conscious of nothing but report noise itself. It is not until this report noise is annulled that we can hear the "bullet flight" noise. This latter noise, being made out in the air beyond the gun, can come back to the shooter only by reflection. If there is one object, we get one reflection and one noise. If there are many separate objects, we get many separate reflections and separate noises. If there are no reflecting objects, such as when shooting straight up into the air, then we get no reflected noise.

For some time it was difficult to determine whether it was accident or otherwise that caused the bullet flight noise to begin when the bullet velocity exceeded the velocity of a sound wave. Study of the problem developed the fact, however, that it was to be expected, and the reason for this is quite interesting. Its study began when we succeeded in getting photographs of the flying bullet.

In these photographs we find that when the bullet velocity exceeds 1,125 feet per second there is a distinct line in the photographic plate, showing the Huyghen sound wave. It emanates from the bullet point very much the same as the bow wave emanates from a fast moving boat. Owing to the difference in reflecting value of air at varying densities, the wave appears very distinctly in the plate. Its velocity of advance is approximately 1,125 feet per second in air at 70 deg. Fahr.. In striking an object it, of course, follows the laws of reflections precisely the same as any sound wave.

It makes the matter a little plainer possibly to look at it as follows:

If the bullet is not moving as fast as a sound wave normally travels, the air is heaped up by the head of the bullet at a rate which is not quite sudden enough to strike the ear drum a blow. Instead, it amounts to a relatively gradual rise in pressure which is inaudible. On the other hand, if the velocity of the bullet is such that the air heaps up in front of the latter at a rate faster than that at which a sound wave normally travels, a sharp enough wave is caused to give the effect upon the ear drum of a blow. This is, of course, audible. In other words, the point where the bullet begins to make a "crack" in the air, or the point where the whiplash begins to make a "crack" instead of a "swish," is when its velocity reaches the point when the air is elevated in pressure suddenly enough to appear upon the ear drum as a blow.

A matter of practical interest in this connection is the noise made by the various popular cartridges in use. The .22 "Short" cartridge and the .22 "Long Rifle" cartridge in both black and smokeless powder give bullet velocities below the velocity of the sound wave. The .22 "Long Rifle" cartridge loaded with Lesmok powder gives a velocity a little higher, and, therefore, gives the bullet "crack." The .22-caliber "Long" smokeless cartridge appears to be just on the dividing line, as some of the cartridges in a box will not make a bullet flight "crack," while others will. The .22 Winchester automatic cartridge gives bullet velocity below the critical, and, therefore, flies quietly. The .22 W. R. F. cartridge gives a little higher bullet velocity than the critical and makes a noise.

Beginning with the .25-20 cartridge and progressing on up to the .45-90, all regular cartridges give bullet velocities which make the flight noise. By modifying the load so as to bring the bullet velocity below 1,125 feet per second, it is possible to avoid the bullet flight noise. This ammunition is used by target shooters for target practice where noise would cause prohibitive disturbance.

Hartford, Conn. HIRAM PERCY MAXIM.

Some Locomotive Curiosities

To the Editor of the SCIENTIFIC AMERICAN:

I was extremely interested in the very valuable contribution to the history of the locomotive engine published in your columns under the above heading on December 16th. The writer of it, Mr. H. T. Walker, displays a remarkable acquaintance with his subject and will, I am sure, allow me to supplement his information about the last engine shown on page 559.

This engine was built in 1830, not 1833, for the Bolton and Leigh Railway in Lancashire by Messrs. Rothwell, Hick & Co. of the Union Foundry, Bolton, who became later on a well-known firm of locomotive builders. It made its first trip on December 2nd of that year, and ran at from 20 to 30 miles an hour, light, and with a heavy train of loaded coal wagons at 12 miles an hour, overcame a gradient of 1 in 440 and a severe curve. Of course, the term "heavy" must be regarded from the point of view of eighty years ago.

The engine comprised, apparently, several novelties in its construction. A local paper understood that the boiler contained a spiral flue, and another that "a separate steam chamber is placed above the portion of the boiler containing the horizontal tubes," this being probably a mistake for vertical. There must, of course, have been a steam space, but it does not appear to have been "separate" in any way. The report continues: "The cylinders, which are only 9 inches in diameter, are placed in a horizontal position, and the motion is communicated to wheels of 5 feet in diameter (made of cast iron, with hollow spokes and hooped with wrought-iron) by means of upright wrought-iron levers and horizontal connecting rods, fixed outside the framing, which allows every part of the machinery to be got at with the greatest facility. The boiler is so arranged as to let the chimney rise out of the center of the steam chamber, which, in addition to the advantages derived from it, adds greatly to the elegant and novel appearance of this engine, which is altogether got up in a very superior manner." The engine was named, probably after its birthplace, the "Union." Only a month after it began working the Kenyon and Leigh Junction Railway was opened, connecting the Bolton and Leigh with the Liverpool and Manchester at Kenyon Junction. The "Union" now began to work through over the latter line to Liverpool with goods and coal trains, but it was not till June 13th, 1831, that the line was opened for passenger traffic. On that day the "Union" made two trips from Bolton to Liverpool and back with two coaches and two open conveyances, technically called "blue boxes," from the color they were painted. These trips occupied 96 minutes on the average; the distance being 28½ miles. On the last trip home it ran from Liverpool to Kenyon Junction, 18 miles, in 35 minutes. Much complaint was made of people walking about all over the line. On June 2nd it had conveyed a special of one coach over part of the Liverpool and Manchester Railway at upward of 35 miles an hour, and was evidently a remarkably speedy machine for those days.

In a list of the Bolton and Leigh and Kenyon and Leigh engines, given in Whishaw's "Railways of Great Britain and Ireland," 1840, the cylinders of the "Union" are given as 9×18, the funnel as 11 inches in diameter and 5 feet long, and the carrying wheels 3 feet in diameter. Mr. Walker's drawing makes them 5 feet, the same as the drivers, and does not show tubular spokes. In those days, however, engines were so constantly altered, as weak points developed, that Whishaw is not necessarily inaccurate. The engine was broken up, unfortunately, and not preserved. The two local lines now belong to the London and North-western Railway.

Chelsea, London, S. W. W. B. PALEY.

Canal Work in December.—Up to January 1st, the grand total of canal excavation at Panama was 158,092,940 cubic yards, leaving to be excavated 37,230,439 cubic yards, or about one-fifth of the entire amount for the completed canal.

The rice terraces at the summit of the mountain.

Savage Irrigation in Luzon

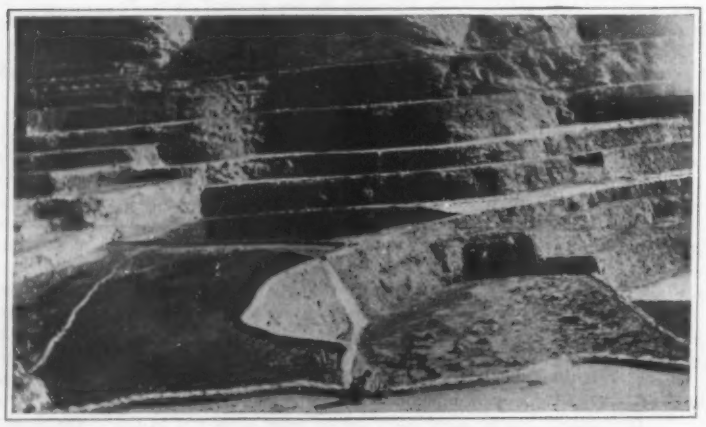
The Wonderful Rice Terraces of the Head-hunting Ifugaos

By Hamilton Wright

With Photographs by the Author

ALMOST every traveler in the Orient has seen or heard of the rice terraces in Japan, China, and the region of the Straits Settlements. The system of terracing is noteworthy for the unique attraction it lends to the landscape and because it illustrates how every available bit of land is used to advantage in densely populated regions. The most wonderful terraces in the Orient, however, have been seen by but few people, and are practically unknown. These are the rice terraces of the Ifugaos, a tribe closely akin to the Igorrotes, and living in the northern portion of Nueva Viscaya Province in the heart of Luzon. The Ifugao terraces greatly surpass the better known and more easily reached terraces of the Igorrotes near Bagulo, the Simla of the Philippines, and, it is said, there is nothing in Java or the Andes that can compare with them.

From an industrial view point the Ifugao terraces represent the most colossal undertakings in the Philippines, and perhaps the most stupendous task ever accomplished by a thoroughly savage people. Viewing the terraces, one compares them with such works as the Pyramids or the great wall of China, or even with the Roman viaducts. In point of combined utility and engineering skill they compare in some respects with the Roman viaducts, although viewed in connection with the primitive condition of the people there is probably nothing comparable to them in the world. By way of contrast with like achievements of more civilized races, it should be mentioned that the Ifugaos are absolutely primitive, even lacking a system of writing and a well-defined religious belief. Their writing up to the time when the American school teacher invaded the country consisted of a few rude hierogiyphics scratched on a rock or in the sand.



Rice terraces near Banaue.

The figure in the foreground gives an idea of the magnitude of the structure. The walls are from 6 to 18 feet high.

Ifugao boys pulling passengers across a swift mountain stream on a bamboo ferry.

The finest of the Ifugao terraces lie along the sides of a steep canyon between the native settlements of Quiangan and Banaue in Nueva Viscaya Province. Here the Ifugaos have constructed these rice paddies like giant steps up the steep canyon sides to a height of 1,200 feet or more, and it is said they extend into a secondary range of hills, making the extension almost 3,000 feet. The distance between Quiangan and Banaue is about twelve miles, and is negotiated by a winding foot path that in some places will not allow two to pass. In one place the trail extends along the retaining wall of a rice paddy. This wall is 18 inches wide and there is a sheer drop of 70 feet below to the next paddy. The paddy varies from 8 to 40 feet in width and is approximately 300 feet long following the contour of the canyon. Some of the terraces, each of which is flooded with water before the rice planting in the early spring, are wonderful feats of engineering. At times they follow the contour of a canyon for as great a distance as half a mile without varying scarcely two inches, say, from a dead level. The retaining walls of each terrace are built to be about fifteen inches above the water level, and when the terraces are flooded it is seen that this condition has been precisely complied with. The retaining wall of each terrace forms one side of the rice paddy, and the hill or canyon on the other side. At the point where the paddy meets the canyon side, the retaining wall of the terrace next above begins, so that there is no canyon so steep that it does not present an unbroken succession of terraces. All retaining walls are perpendicular and built at right angles to the level of the earth.

In the art of intensive cultivation the Ifugaos have progressed far. They irrigate and fertilize in a single operation. Water

(Concluded on page 116.)

Marvelous terraced pyramid of the Ifugao savages in Nueva Viscaya Province, Luzon. Note the settlement and houses at the top of the pyramid.

Vickers automatic rifle-caliber gun on adjustable tripod. Seat being used as knee pad.

Lowest firing position with adjustable tripod. Gun 16 inches above ground. Angle of elevation does not alter in training. Seat being used as elbow rest.

The New Vickers Light Automatic Rifle-caliber Gun and Its Adjustable Mounting

By the English Correspondent of the Scientific American

RECENTLY an improved type of the familiar Vickers light automatic rifle caliber gun has made its appearance, and commands attention owing to its greater mobility and ingenious tripod. In the main the principle of the gun remains the same as the service Vickers weapon of this type. The chief alteration is in the inversion of the lock, and the trigger bar is taken to the top of the casing, which is reduced in depth and which requires the crank to revolve in the opposite direction.

An appreciable reduction in weight has been also effected, for whereas the older weapon ready for use weighed 68¾ pounds, the new gun weighs only 36 pounds. This lessening of weight has been obtained by the use of high-class steel instead of gunmetal in the construction of all the parts, with the exception of some of the details of the water jackets, such as the water tubes, which are made of brass. Moreover, owing to the lightness of the recoiling parts, no muzzle attachment is required, so that no time is wasted in cleaning.

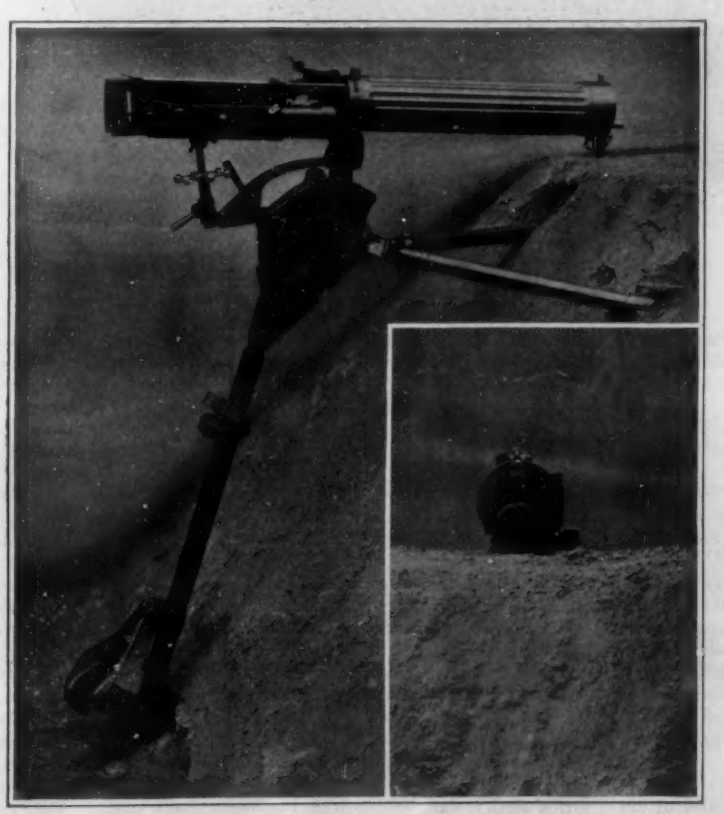
The inverted lock is of an improved type, the details having been simplified so that it can be stripped and assembled without using any tools beyond an ordinary punch. It is arranged so as to give an extra forward movement after the cartridge is placed in the chamber, whereby the shell charge is supported firmly at the instant of explosion, thus minimizing any tendency to break or to separate during firing.

The most important feature is the adjustable tripod which enables the gun to be raised or lowered to suit any height of protection, either on a level surface or a sloping bank, and in such a way that the angle at which the gun is laid is not altered. The mounting can also be used as a parapet mounting with the training pivot vertical.

When it is desired to alter the height of the gun all that is required is to raise the rear leg of the tripod and to turn the adjusting handle until the desired height has been attained. The line of sight can be varied by sixteen inches, ranging from a minimum of 16 inches to a maximum of 32 inches, off the ground. About sixteen turns of the handle are required to raise the mounting from the lowest to the highest position.

No matter what may be the position of the gun it can be trained about the vertical pivot without altering the angle of elevation. The angles of training are marked off on the training arc, and in order to limit the training between any desired points, two stops are provided which can be moved on the training arc and secured in any position. The maximum angle of training is 30 degrees on either side of the center.

Highest firing position of the adjustable tripod. Gun 32 inches above ground. Angle of elevation does not alter in training. Seat being used for sitting position.



The automatic gun ready for use behind an embankment presents a very small exposure, shown by the area seen in the lesser view.

A NOTEWORTHY IMPROVEMENT IN MACHINE GUNS

The mounting is constructed with a top carriage consisting of cross head, elevating gear, training arc and training socket, which is movable on guides on the top of the adjustable tripod consisting of casing with adjusting gear, front legs, rear leg or trail and seat.

The front legs are attached to a Y-piece pivoted in the front bearing, which receives its movement when the adjusting nut is raised or lowered. On each side of the Y-piece is a bolt with an eccentric clamp for use in attaching the front leg, and above and radial from the bolt is a toothed segment adapted for engaging the teeth formed at the top of the front leg. By means of this arrangement the mounting can be adapted to uneven ground. The slope of the ground on which the gun may be adapted with the training pivot vertical varies from 5 degrees descending to 60 degrees ascending.

The front legs are made of steel tubing fitted with shoes to prevent their digging into the ground, and at the upper end with a link having a longitudinal slot so that they may be withdrawn from the teeth in the Y-piece or folded conveniently to the side of the tripod for the purpose of transport. The rear leg or trail is made of steel tubing with a fitting at the top end which hinges in the rear bearing, and which receives its movement from the adjusting nut. The lower end is provided with a trail shoe which has a deep flange to prevent it from slipping along the ground.

The seat is made of thin steel plates flanged and pressed into shape. It serves as a seat for the higher firing positions, and, being carried on hinged brackets and a sliding sleeve, can be pushed down flat on the trail to form a kneeling pad for the intermediate firing positions. The upper part of the seat is made in halves, which are hinged in front and which can be swung round horizontally to form elbow rests for the lower firing positions. The seat is locked in its different positions by a sliding bolt which has two projections engaging the seat flanges when the halves are together, and a projection moving in slots in the seat hinge when the halves are forward and forming elbow rests. When in this position a projecting piece in front from a washer secured to one-half of the seat hinge prevents the rear end from being raised, and by this means the sliding sleeve is held from moving.

The accompanying illustrations show the tripod in use and also the adaptability of the weapon to uneven ground. When the gun is being used from behind a protection or embankment, the area exposed on the other side is extremely small.

The Heavens in February

Sirius, Its Neighbors and Its Companion; the Planets and Their Phenomena

By Henry Norris Russell, Ph.D., Professor of Astronomy in Princeton University

F all the stars in the heavens Sirius is perhaps the most widely known by name. It is certainly one of the easiest to learn and recognize. Its enormous brightness—more than four times that of any other star visible in our latitude—would suffice for this purpose, and its position—pointed at by the line of the belt of Orion, carried downward about 20 degrees—is equally distinctive. The neighboring stars in its own constellation of the Great Dog also form an easily remembered group—especially the irregular cross about 15 degrees southwest of Sirius (one star of which is not shown on our map but is fairly prominent to the eye). These other stars are brighter than they appear to the casual observer, who is likely to be deceived by the enormous brilliancy of Sirius into thinking that his neighbors are faint. By hiding Sirius with the hand, it is easy to satisfy one's self that β Canis Majoris (nearby on the right) and δ and ϵ in the cross below, are fully as bright as the stars of Orion's belt. Almost all the principal stars of Canis Major, except Sirius, are of the spectral type shown by so many of the stars of Orion, and, like the latter, are almost fixed in the heavens, showing extremely little proper motion.

It is probable that these stars are enormously remote and really much brighter than Sirius—so much so, in fact, that it is doubtful if the latter, if removed to the same distance, would be visible at all to the naked eye.

Sirius itself is one of our very nearest neighbors, being at a distance of a little over eight light-years—that is, 550,000 times the Earth's distance from the Sun, or 51 millions of millions of miles. Careful and repeated measures of its parallax have sufficed to determine this distance, great as it is, with an uncertainty not likely to be much over two per cent of the whole.

At this distance the Sun would appear as a star a little brighter than the second magnitude—that is, very nearly as bright as the star β Canis Majoris appears to us. The apparent difference in brightness between Sirius and this star—which is about 6 degrees to the west of it—therefore serves as a good illustration of the extent to which Sirius really outshines the Sun. According to the latest measures, it gives out 24 times as much light as the latter.

Sirius is also noteworthy as a double star, and its history in this connection presents some phases of unusual interest, as the existence of its faint companion was proved before it had ever been seen.

The stars in general are in motion—slow but undoubted—across the face of the heavens; and in all but a very few cases, this motion follows a straight line, and is at a uniform rate. In the exceptional instances some force must be at work on the star to pull it out of the line in which it would naturally tend to move, and the only known force capable of producing such an effect is the attraction of a companion star. When we have two stars in orbital revolution, gravitational theory shows that neither one will be stationary. A certain point on the line joining them—the "center of gravity"—will remain fixed (or move uniformly), and the two stars will describe orbits around this point of the same shape but different sizes, keeping always on opposite sides of it. If one star is twice as massive as the other, it will be half as far from the center of gravity as the other, and similarly in other cases.

Sirius has naturally been very carefully observed, and its position in the heavens has been accurately determined every year. Plotting these positions (after the fashion indicated by the large white dots in the diagram), it was found that they do not lie on a straight line, but on a curve having a peculiar kink in it which is repeated at intervals of about 50 years. It was therefore natural to suppose that Sirius had a faint companion (invisible in the telescopes then existing, but sufficiently massive to modify the motion of the bright star by its attraction), which approached relatively near it at intervals of about 50 years (when the deviations of the bright star were most conspicuous), and so must revolve about it in this period. This conclusion was reached and announced by Bessel before 1850. Years later, in 1862, Alvan Clark, the great maker of telescopes, had just completed a new object-glass of large aperture and great power. Turning the newly-finished telescope on Sirius to test the performance of the lens, he noticed at once a faint companion. A few years' observations showed that this faint attendant (which is scarcely $\frac{1}{10000}$ as bright as Sirius itself) was moving with the bright star; and later observations have proved that it revolves about the latter in an elliptical orbit in a period of 49 years—almost exactly the value predicted by Bessel.

The annexed diagram (drawn to scale from data given in Prof. Boss's great Catalogue of Stars) shows the positions of Sirius and its companion at intervals of five years from 1850 to 1920. The large white dots represent Sirius, the small ones the faint companion. The center of gravity of the system (indicated by a cross mark on the line joining the two stars) moves uniformly in a straight line; but as the stars revolve around this moving point (keeping on opposite sides of it, with the companion always two and one-half times as far from it as the principal star), both their paths become curved lines, described with a varying velocity.

The small diagram at the top shows the elliptical orbit found for the companion, when we measure its position from the bright star as a center. Its relatively rapid motion when near the principal star is a direct result of the greater attraction between the two at this time. The actual orbit is somewhat large, and more nearly circular than that shown, and is inclined about 45 degrees to the line of sight, so that the apparent orbit (shown in the diagram) seems dislocated in shape, just as a circle seen nearly edgewise looks like an eclipse.

Orbit of the companion of Sirius.

Apparent positions of Sirius and its companion, 1850-1920. From data in Boss's preliminary general catalogue of stars.

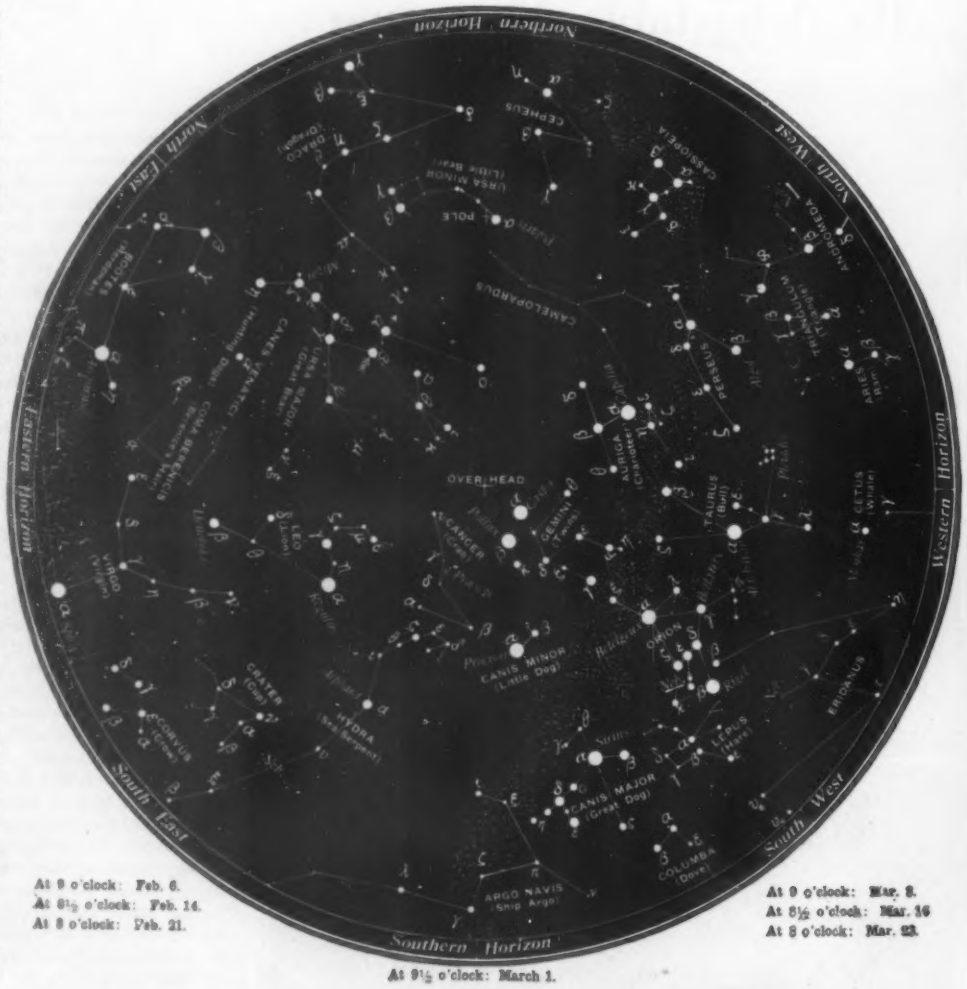
The actual distance between Sirius and its companion averages almost exactly twenty times that which separates us from the Sun. As the orbit is highly eccentric, the distance varies from a little over 8 to almost 32 times this astronomical unit of length. When the companion was last nearest to Sirius (which happened in 1894) the glare of the bright star hid it from view in even the greatest telescopes. At the next close approach, in 1943, the more powerful instruments of that day may be able to follow it all through its course.

Knowing the real dimensions of this orbit and the period, it may easily be computed that the mass of Sirius (i. e., the total quantity of material in it) is very nearly two and one-half times that of the Sun, while the companion almost equals the Sun in mass (though it gives out only $\frac{1}{4000}$ as much light).

So far we are on solid ground, our conclusions depending on careful and reliable observations worked out by well-understood principles of mathematics and physics; and we have accumulated a surprising collection of facts about the system of Sirius. If we wish to go farther and ask how big is Sirius (i. e., what is the actual diameter of this bright star, compared with that of the Sun), and how hot is its surface, we have a smaller observational basis on which to proceed; indeed, a few years ago we should have had none at all.

But, very recently, careful studies have been made of the relative proportion of red and violet light given off by various stars. From this, on simple and very probable assumptions, the temperature of the star's

(Continued on page 117.)



At 9 o'clock: Feb. 6.
At 8½ o'clock: Feb. 14.
At 8 o'clock: Feb. 21.

At 9 o'clock: Mar. 8.
At 8½ o'clock: Mar. 16
At 8 o'clock: Mar. 23.

At 9½ o'clock: March 1.

NIGHT SKY: FEBRUARY AND MARCH

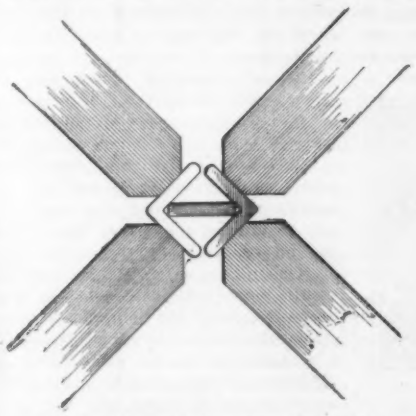
Suggestions for the Workshop

Ingenious Expedients of Resourceful Mechanics

An Emergency Two-jaw Chuck

By N. M. Powell

ONE often needs the two-jaw chuck when it is being used by others. This difficulty can be overcome without loss of time, by using as a substitute two pieces of angle iron, about three inches long, in the universal



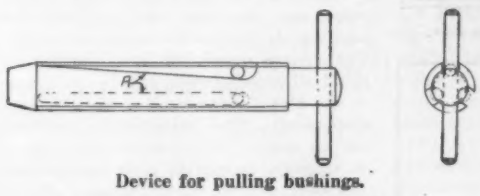
Holding flat work in a four-jaw chuck.

four-jaw chuck. Let the flat ends of two adjacent jaws bear against the two sides of the angle, as shown in the sketch. The size of angle necessary will depend upon the size of the stock you wish to mill.

Inside Pulling Grip

By H. D. Chapman

THE accompanying sketch shows a clever little device for pulling bushings. The writer had a large number of telescopes to repair, and there was a small bushing to be taken out of the main tube of each. As the bushings were flush with the outside face of telescopes, it was hard to get them out. It was to solve this difficulty that the pulling device was devised and it worked very well. This device was made of tool steel, and three grooves were equally spaced and cut as



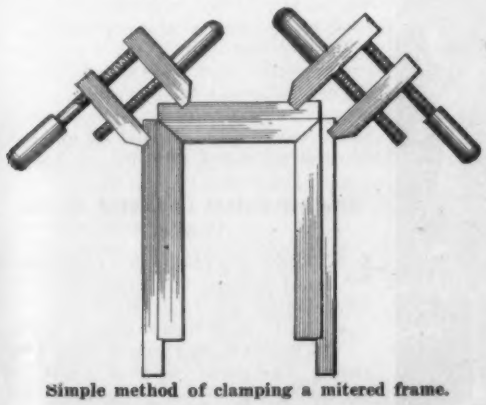
Device for pulling bushings.

shown at *A*. These grooves were cut on an angle, so the balls would have chance to ride up on the angle and grip the inside of the bushing or pipe. The balls were hard and of a size to fit the bushing that was to be pulled. The tool was easily released by laying it horizontally and pushing it in until the balls rolled back in their recesses.

How to Clamp a Mitered Door Frame

By Joseph Vaghi

THE task of clamping a door frame while the glue is setting is not as difficult as may appear at first sight. The accompanying illustration shows how the



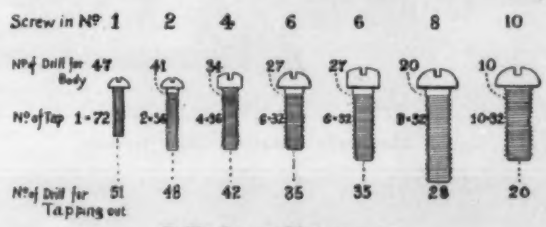
Simple method of clamping a mitered frame.

clamping may be done in a very simple way. About the frame of the door, three pieces of wood may be fitted, each provided with a notch near the corner, adapted to receive the jaws of a pair of cabinet-maker's clamps. The side pieces are also cut to provide a shoulder on which the lower ends of the door frame are supported. When the clamps are tightened, the door frame is drawn tightly together and the parts are thus held until the glue sets.

Drills for Screws and Taps

By Albert F. Bishop

THIS drawing shows a number of machine screws which are frequently used by the model maker or mechanic. He selects the size screw that he desires to use, compares it with the screw on the drawing, quickly sees the number of drill for drilling hole for the body size, also the number for tapping out for the thread. The most convenient way is to attach these machine screws themselves to a cardboard by sew-



Drills for machine screws.

ing with thread and placing numbers about the screws like the drawing.

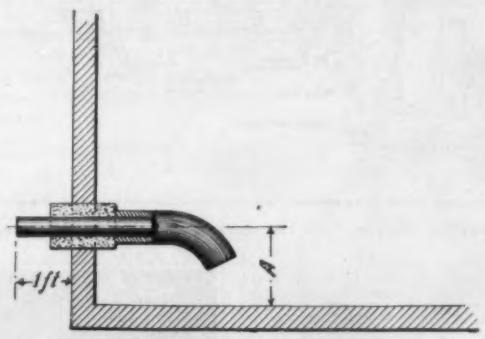
SIZE DRILLS FOR PIPE TAPS.

1/8	inch	21/64	inch
1/4	"	7/16	"
3/8	"	37/64	"
1/2	"	45/64	"
3/4	"	29/32	"
1	"	1 5/32	inches
1 1/4	inches	1 1/2	"
1 1/2	"	1 3/4	"
2	"	2 7/32	"
2 1/2	"	2 21/32	"
3	"	3 9/32	"

Burnt-gas Exhaust for a Garage

By H. M. Nichols

WHEN running an automobile engine with the car standing in the garage, the burnt fumes accumulate in a short time, and make the air very disagreeable to breathe. These fumes are poisonous, and if the



Exhaust outlet for a garage.

engine is not working properly they are also likely to be explosive. The average automobilist runs his engine a considerable amount with the car standing in the garage, for the purpose of adjusting spark coils, timers, carbureter, etc., and while in the summer time he can leave the doors open, and thus get rid of the most of the burnt gas, this is inconvenient in cold weather.

The accompanying sketch shows the general details of a burnt-gas exhaust for the garage, designed to carry all of the poisonous exhaust fumes out of doors. All the materials required are a piece of iron pipe about two feet long, having the same diameter as the exhaust pipe on the car (or it may be slightly larger), a piece of flexible rubber hose about two feet long, and some sheet asbestos.

Cut a circular hole in the rear wall of the garage in line with the exhaust pipe on the car. This hole should be two inches larger than the outside diameter of the pipe. Where the pipe fits in the wall, wrap it with the sheet asbestos until it fits snugly. Wrap the asbestos with copper wire to hold it in place, allowing the ends of the asbestos to project two or three inches beyond each side of the wall. The distance *A* from the floor to the center line of the pipe should be made the same as the height of the exhaust pipe on the car. Slip the hose over the end of the pipe, and wire it in place with copper wire. When testing out the engine, before starting, slip the free end of the hose over the exhaust pipe.

After long use the hot gas will destroy the life of the flexible hose; but the cost of renewals is small, and is more than paid for by the comfort and safety obtained by conducting all the products of combustion outside of the garage.

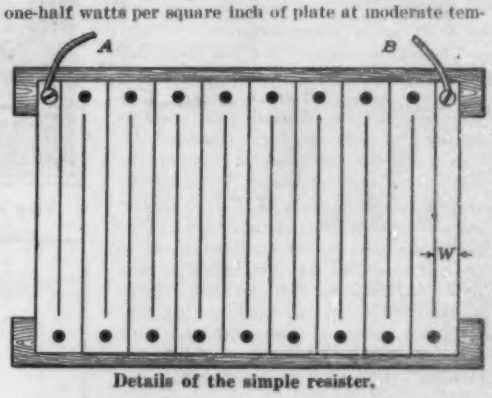
A Simple Resister

By Frederick E. Ward

IN practical electrical work, as well as in experimenting or testing, a crying need is often felt for a suitable form of resistance adapted to the particular purpose in hand. When it happens that it is necessary to use an arc lamp on a circuit of a higher voltage than that for which it was made, or to charge or discharge storage batteries, or to do any other of the many things that require the use of a resister, it is but seldom that one can be found having a suitable resistance in ohms combined with ample current-carrying capacity.

In the sketch is shown a form of resister that can be improvised in a few minutes from materials readily obtained. It consists of a sheet of roofing tin, or sheet iron (the thinner the better) slit with a pair of snips and tacked on two insulating strips with carpet tacks as shown. Where no great amount of heat is to be liberated wood strips can be used, but it is always safer to use some fireproof material such as asbestos board or magnesia board. Terminal wires, as *A* and *B*, are best attached by small stove bolts.

Such a resister may be expected to dissipate one and one-half watts per square inch of plate at moderate tem-



Details of the simple resister.

peratures, or four or five watts per square inch without being heated to redness.

The resistance that any given sheet will acquire on being slit depends upon the width *W* of the strips into which the sheet is divided. This width can be calculated from the formula

$$W = \sqrt{\frac{0.005 \times A}{T \times R}}$$

where

W = width of strip in inches,
A = area of sheet in square inches,
T = thickness of sheet in thousandths of an inch,
R = the desired resistance in ohms.

A practical example will make the use of the above clear. Suppose it is desired to make a resister through which to charge an 88-volt vehicle battery from a 120-volt circuit at the rate of 25 amperes.

The voltage to be consumed by resistance is $120 - 88 = 32$ volts. At 25 amperes the necessary resistance, *R*, to do this is $32 \div 25 = 1.28$ ohms.

Now, the watts to be dissipated are $32 \times 25 = 800$ watts. Allowing about 1½ watts per square inch of plate, it will be seen that a standard sheet of 20 x 28 roofing tin, having an area of 560 square inches, will be large enough to become only reasonably warm in use.

Suppose the thinnest sheet that can be obtained measures 11½ thousandths of an inch thick. Then, by substitution in the formula we have

$$W = \sqrt{\frac{0.005 \times 560}{11.5 \times 1.28}}$$

$$= 0.436 \text{ inch.}$$

This is so near 7/16 inch that the latter value may be used, and it will suffice to mark the tin in 64 strips of 7/16 inch each and make the required 63 incisions in the manner shown in the drawing.

The Inventor's Department

Simple Patent Law; Patent Office News; Inventions New and Interesting

The Cow and the Machine

THE patient cow has been the subject of a great many experiments with a view to expediting the tedious operation of milking. As a rule, the methods employed have not been at all to the liking of the animal. However, the apparatus illustrated herewith aims particularly to accommodate itself to the form of milking to which the cow has been accustomed from time immemorial.

The machine imitates the operation of the hand. As shown in the photograph, the entire apparatus, with a small electric motor which operates it, is attached to the cow by means of two straps. Details of the milker proper are shown in the line drawing. The backbone of the device consists of two fixed bars on each side of which are two fixed plates and two movable compressing plates. The operation of the compressing plates is controlled by a cam. The compressing plates are mounted upon two rods, each provided with a roller engaging its own particular cam groove. The upper part of the plates is moved forward or toward the stationary plate, first compressing the teat, after which the lower part of each plate is moved forward while the upper part remains stationary. When the plates are retracted both the upper and the lower cam rods move in unison, so that the plate is withdrawn in parallel to the stationary plate. The power required to operate the machine is very slight, being somewhat less than that required in a 16 candle-power lamp.

The milk is collected in a pan suspended below the machine and delivered thence into the milking pails or cans. The apparatus is open, permitting the operator to see the milk flowing; consequently, if any trouble develops in any of the teats it is only necessary to place the teat in question back of the stationary plate so that it will not be milked. The plates are covered with rubber so as to prevent injury to the cow, and they may be readily removed and cleansed. Owing to their flat form, and the fact that they do not come in contact with the milk, there should be little danger of infection from this source. The collecting pan can, of course, be cleansed in the usual way.

A Vest-Pocket Transmitter for the Telephone

THE widespread use of the telephone by the general public, giving access indiscriminately to persons suffering from all forms of disease, such as tuberculosis, pneumonia, la grippe, etc., has been recognized by bacterologists and all qualified to know, as a menace to health.

Many efforts to remedy this evil have been made, but the suggestions offered heretofore seem to be either impractical, or open to other objections. As the danger lies in the transmitter, the only solution is to individualize this. The types in present use are too heavy and bulky to carry around. What is wanted is an instrument which combines power and clearness with great lightness and small size; one which can be attached in an instant to the existing line without interfering with the present installations; and which automatically cuts the connection from the local infected transmitter and diverts the current into the attached individual transmitter during use. This problem has been attacked by Charles L. Chisholm, a Canadian inventor, of Marysville, New Brunswick, who is at present carrying on his work in a laboratory in Brooklyn.

Mr. Chisholm is at a great advantage in prosecuting this kind of research, through the fact that he is a trained musician, having been schooled as a violinist both in the practice and theory of music. His ear is therefore highly sensitive in detecting and analyzing the various natural and adventitious sounds emitted by the telephone diaphragm.

There are a number of features in the new transmitter which deserve special mention. The small size of the instrument is not a purely accidental feature, introduced simply with a view of reducing the size of the apparatus—it has a scientific and practical reason more important than this. The diaphragm is made very small, of gold-plated silver, its dimensions and material being so chosen that its fundamental note is much higher than the frequency of any normal human voice. In this it differs markedly from the ordinary telephone transmitter whose diaphragm has a low fundamental. Mr. Chisholm claims that this is a defect, as it introduces into the sound of the vibrating diaphragm, notes foreign to the original sound of the voice. The use of a diaphragm with a high fundamental is designed to avoid this defect and to render the articulation clear.

The accompanying illustrations will give an idea of some of the details and of the general appearance of the new transmitter.

Fig. 1 shows the vest pocket transmitter as designed for general use. The instrument is contained in a watch case, and on pressing the button which releases the lid of the case, the latter springs open just like a watch, and the collapsible mouth piece, containing a helical spring, opens out ready for use. The entire instrument, mouth piece and transmitter, is contained within this small watch case. If desired, it can even be made part of an entire watch, which need not be any thicker than those commonly in use. The case has two sockets which connect with terminals on the telephone stand, at the same time cutting off the public transmitter.

Fig. 2 shows some details of the transmitter. This latter is about an inch in diameter and weighs about an ounce. It contains nine parts, including the indestructible outer casing.

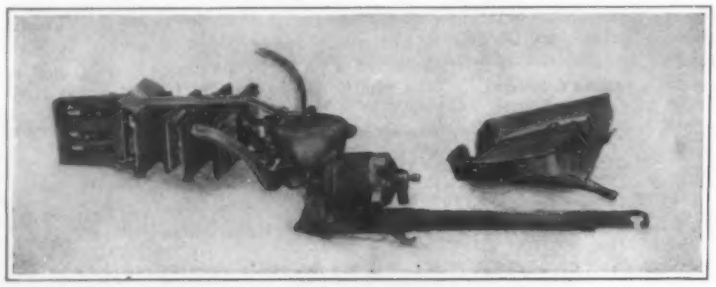
The usual types have from 38 to 53 distinct parts, according to make, and many adjustments.

The minute instrument has but one adjustment and cannot get out of order.

In Fig. 2 *a* is a silver diaphragm, gold plated on the face engaging the granular resistance material of the microphone. This diaphragm has an exceedingly high fundamental, far above any normal human voice, and therefore does not reinforce any sounds to the detriment of others. The minute sound box *b* is designed to avoid all reverberation, taking advantage of the high fundamental of the sensitive diaphragm. The microphone therefore has no sounds foreign to the voice waves to magnify, except the high fundamental and overtones of the diaphragm, all far above the fundamentals and overtones of the human voice, thus insuring clear articulation, and the preservation of the human element of the voice. The back electrode and yieldingly mounted support are shown at *c* and *d*.

One of our halftones shows the pocket transmitter attached to an ordinary telephone stand and in actual use. The stand is provided with the usual public mouthpiece, but on attaching the individual transmitter, the public instrument is automatically cut off and the current diverted to the individual branch. If preferred, the stand can of course be made without any public transmitter, and used solely with the individual instruments.

For analyzing in comparative tests the relative merits in articulation and power of his own and other transmitters, the inventor uses a special electro-magnet sound recording apparatus of his own design and of marked efficiency.



Electrically operated milking machine.

View showing the method of mounting the milking machine on the cow.

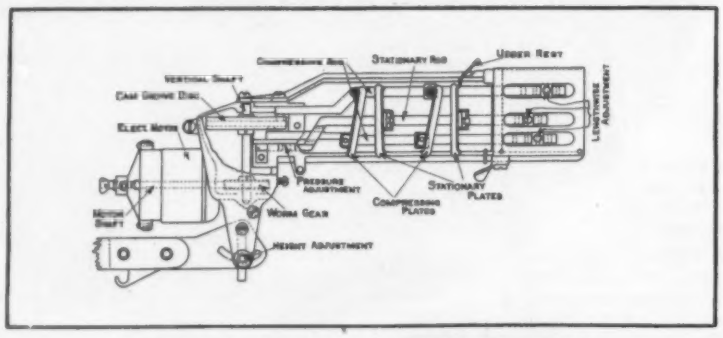


Diagram showing how the machine imitates hand-milking.

Fig. 1.—The watch-case transmitter.

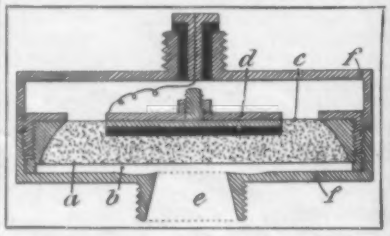


Fig. 2.—Section through vest-pocket transmitter.

Fig. 3.—Pocket Transmitter in Use.

Another Patent Dedicated to the Public

LETTERS PATENT No. 1,013,800, issued January 2nd, 1912, to Drs. Willy Meyer and Julius Meyer of New York, N. Y., have been dedicated to the use and benefit of the people of the United States. The patent covers an apparatus for conducting thoracic operations and relates generally to a device for producing, maintaining and regulating different air pressures in airtight chambers, and more specifically consists in improved apparatus for constructing separate airtight chambers

In which the body and head respectively of a patient may be conveniently maintained under different air pressures during a surgical operation on the body, while the patient is under the influence of an anesthetic.

It is well known that if the thorax of a living being is opened by an incision sufficient to permit entrance of air the lungs collapse and death ensues. The Messrs. Meyer discovered that under certain conditions the physiological condition can be approximately maintained if the air pressure to which the opened thorax of the patient is subject is made less than that of the air which he breathes; the collapse of the lungs does not then occur, and under these conditions extensive operations on the thorax may be safely conducted.

To accomplish this it has been proposed to place the head of the patient in a separate chamber in which the air pressure above the tension of the exterior atmosphere may be maintained, or to place the body of the patient in such a chamber in which a pressure is maintained below that of the exterior atmosphere into which the head of the patient projects. In the apparatus produced prior to the Meyer invention the operation has to be finished under the kind of pressure, above or below atmospheric pressure, under which it is begun. It is moreover conducted with some difficulty because of the cramped position in which the surgeon is compelled to work, the impossibility of his seeing his patient's face, the difficulty of convenient communication with the assistant who administers the anesthetic, who is in another compartment, the impossibility of anyone's entering or leaving the operating room when a partial vacuum exists therein except through an air lock, without collapsing the lungs of the patient, and finally the difficulty of properly regulating the pressure of the air. Where these problems have been partially solved in previous constructions, the administration of the anesthetic has been rendered more complicated.

The Meyer patent claims to overcome all of these difficulties and to enable the most extensive thoracic operations to be performed with the same ease and safety as any other operation of the same magnitude not requiring special atmospheric conditions.

The Meyer patent contains eighteen claims and involves a discovery that will be a great boon to hospitals and to surgeons. Before the patent was granted, an instrument was filed in the United States Patent Office and recorded on September 8th, 1911, in which the inventors transferred their rights to the public at large for the entire term of the patent.

The dedication to the people of the United States of the Meyer patent covering apparatus for conducting thoracic operations is another example of public spiritedness which should not be passed over without proper recognition. As in the case of the Diamond Match Company, who dedicated certain match-making formulæ to the public, less than a year ago, it is a case where the unselfishness of a patentee is conclusively proven.

The precise value of the device covered by the Meyer patent will of course be best appreciated by the medical and surgical profession, but it is sufficient for the public at large to know that it aims at an improvement along lines where puzzling problems confronted the profession, and gives a patient who has to undergo a long and severe operation in surgery, a better chance for his life.

In connection with the matter of dedicating patents and rights thereunder to the public, the question arises as to whether or not the law should provide that such public spirited individuals should be allowed to prosecute their applications through the Patent Office without the payment of fee, in other words at government expense. Under the present patent law the only persons who are allowed to have patent applications prosecuted at government expense are employees of the government who assign their rights to the government. This does not necessarily mean an assignment to the general public, but refers more particularly to those inventions, such as ordnance, etc., which are of peculiar use to the government.

Of course a law which would permit persons to file applications for patent without the payment of a fee, on the avowal of an intention to dedicate the invention to the public, might result in an avalanche of worthless applications. These might interfere with other cases and the expense of conducting interferences and suits would thus be placed upon the public. No such sweeping modification of the law could be expected in view of these possibilities, but it is not apparent why there should not be such a change in the law as would permit an applicant to file his papers, pay the regular required fee and announce beforehand that he wishes to dedicate the patent if issued to the benefit of the public at large. Then should the Commissioner of Patents or other interested government officer decide that the patent is acceptable for the use intended, the fee could be returned.

As the law stands now, however, those who dedicate patents to the public must pay the cost of prosecuting the patent out of their own pockets, without chance of any other reward than that of a consciousness of having contributed to the public welfare.

Notes for Inventors

A Patent to James J. Hill.—A patent was granted to James J. Hill, No. 1,014,648, for a track leveling machine. This comprises a skeleton pyramidal frame, constructed throughout of thin tubes welded together to form a substantial support for the indicating appliances which it carries. Machines to be pushed along the track by hand to determine and give continuous indications whether the track is out of level, and if so, how much. The narrow claims which were obtained would seem to indicate that the invention is not very novel in principle.

A Plumbing Improvement Wanted.—A master plumber, who is a practical man, tells us that an improvement is needed in the outlet or plunger valve of the low down tank. This valve is now almost universally made in the form of a hollow rubber ball which is so stretched and distorted by the suction or pull of the water that goes down the discharge pipe that it soon leaks and must be replaced. What is needed is a valve that will form as efficient a closure in shutting off the water as the one now in use and will not quickly deteriorate under the strain of operation.

A Glove with Finger Nails.—In patent No. 1,010,283, Wm. C. Loy of Rochester, Ind., assignor of two-thirds to Henry F. Crim and Christian Hoover of same place, is shown a glove provided on the outer ends of its finger tips with separate plates in imitation of finger nails so that the glove will in use simulate the appearance of a hand.

Preventing Renewal of Incandescent Lamps.—Matthew M. Merritt of Middletown, Mass., in patent No. 1,010,295 seeks to provide a non-renewable incandescent lamp in which there is a purposely applied incision upon the bulb of insufficient depth to affect the useful strength of the bulb, but sufficient to cause a puncture of the bulb when it is subjected to an abnormal heat such as that applied in "burning out" the deposit in the bulb of the old lamp.

A Treadmill Spading Machine.—In a patent now expired, a California inventor provides a spading machine on the main frame of which was mounted a treadmill in which a horse or mule could be placed to operate the treadmill and so work the spading devices. The spade by means of suitable pawls turned the traction wheels to move the machine over the ground as the spading proceeded. To move the machine from place to place, the treadmill could be geared directly with the traction wheels. The horse thus took himself for a ride.

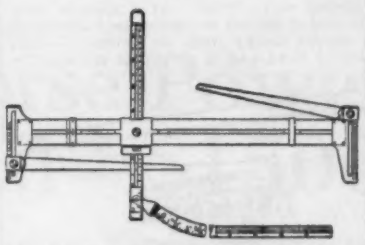
RECENTLY PATENTED INVENTIONS.

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

GARMENT HANGER.—CHARLOTTE W. HEWLETT, 253 Madison Avenue, Flushing, N. Y. This invention provides a hanger for supporting skirts, waists, trousers and other garments, and arranged to take up very little room in a closet or other place, and to allow the use of a series of hangers, one suspended from the other, with a view to suspend any desired number of garments, so that any one of the garments can be readily removed or replaced without unduly disturbing other garments and hangers.

TAILOR'S MEASURE.—A. N. WALQUIST, 120 Melrose Avenue-North, Seattle, Wash. A plan view is shown herewith of a complete measuring instrument for quickly and accurately determining the height and level of

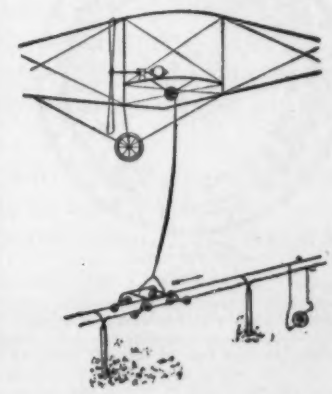


TAILOR'S MEASURE INSTRUMENT.

shoulders as well as the pitch of the head and neck, to be used in drafting patterns and cutting garments, more particularly coats. A perfect and graceful fit of a coat or similar garment on the shoulders can be obtained, whether they be high or sloping or one lower than the other, also whether the head be carried forward or erect.

Electrical Devices.

TRANSMISSION OF ELECTRIC POWER.—T. T. KRYSHTOFOVICH, 3939 Magnolia Avenue, St. Louis, Mo. The object of this invention is to provide a simple means of transmitting electric power to a light-weight motor in an aeroplane with intermediate means on the aeroplane for varying the distance between the machine and the trolley supply line below. The intermediate means on the aeroplane is a spring drum which automatically unwinds as the aeroplane rises and winds up the conducting wires as it descends. There is a special construction of the trolley carriage frame by which it is held firmly to the feed wires, as will be observed in the lower part of the illustration, and cannot be readily detached therefrom. The current is supplied from a central station. The invention appears to be very simple and practicable and applicable for various purposes, such for example as the transport of mail matter at fast speed from one point to another.



MEANS FOR TRANSMISSION OF ELECTRIC POWER.

Of Interest to Farmers.

METHOD FOR MAKING AND PACKAGING BUTTER.—J. DE LISLE, deceased, New York, N. Y.; AGNES DE LISLE, administratrix. The object of this invention is to provide a new method for making and packaging butter aseptically, that is, absolutely free of microbes liable to produce fermentation or putrefaction in the butter or disease in the intestines or other organs of the consumer of the butter.

CORN HARVESTER.—J. HETTRICH, P. O. Box 664, Lincoln, Neb. The present invention is an improvement over the prior patent, No. 917,606, of Mr. Hettrich, and his object is to eliminate the strain on the finger bars, and on the cam tracks in the said patent, and to permit the making of the cam tracks of uniform width, whereby to increase the wearing capacity and life of the machine and to decrease the power needed to operate the same.

CORN HARVESTER AND SHOCKER.—J. J. LONSWAY, Box 44, Fostoria, Ohio. This apparatus cuts standing corn, assembles it in shocks, and deposits the shocks on the ground with the parts thereof in spaced relation, for the purpose of ventilation. Means provide for assembling the stalks in shocks, with provision for intermittently rendering the feeding mechanism to said assembling mechanism inactive while the assembled shock is being deposited on the ground.

Of General Interest.

BRICK HOLDFAST.—M. ABARNO, 971 Kelly Street, Apartment 1-D, Bronx, New York, N. Y. An object here is to provide a holdfast which can readily be inserted at suitable intervals between juxtaposed building elements and form a means for securing the bricks or other building members in alinement, and also a soft foundation, into which nails or other fastening devices may be driven to support grounds, planking, or furring, in position on the walls.

PROCESS OF PREPARING WHEAT.—J. BREWSTER, Dragoon, Ariz. In this instance the object of the invention is to provide a new and improved process for use in preparing wheat as a food product, which is exceedingly nutritious and sweet, easily digested, and capable of remaining in proper condition for an indefinite period of time after the operation of canning.

ARMOR PLATE.—H. SAVAGE, Seraing, Belgium. The object here is to provide an arrangement that will permit of armor plates resisting the attacks of projectiles provided with a cap. The plate is formed with two superposed plates having together the thickness which would be given to a single plate having a hardened face, in view of the resistance to the penetration which it is required to obtain.

FIRE ESCAPE.—H. A. WEISFELD and J. WEISFELD, care of H. D. Baum, 62 East 103rd Street, New York, N. Y. This invention provides an escape having a construction at the bottom thereof adapted to serve the purpose of a net, means being provided for supporting the structure away from the ground. Operating means are provided whereby the escape may be positioned on the front of the building. The escape has a hose connected thereon, the latter having outlets opposite floors of the building, whereby a water supply may be brought to each floor.

CARPENTER'S GAGE.—F. WESTENDAHL, 718 New Sixteenth Street, Lewiston, Idaho. This gage is for use in placing and marking inside casings of door and window frames, and has reference more particularly to a device of this class which comprises a body, adjustable means for determining the position of the body longitudinally and transversely of its length, and a movable marker carried by the body.

VALVE.—J. OGG, Pahala, Hawaii. Use is here made of a casing having an inlet and an outlet and provided with means engaging the casing to regulate the flow of water passed through the casing, the said means being preferably spring controlled and so constructed that when the valve is in operation the water or other liquid will at all times act against the said means to hold the valve in closed position.

FRAME FOR REINFORCED CONCRETE STRUCTURES.—A. H. TASHJIAN, care of F. A. Rumery Co., 3 Center Street, New York, N. Y. An object of this inventor is to provide a frame which is composed of parts so constructed as to present a maximum contact area to the concrete. Another is to provide frame members which can be readily fabricated into a rigid frame. Still another object is to provide frame members which by slight alteration, i. e., in the form of secondary bars, may be fabricated into frames of variable depth.

STEREOSCOPIC CAMERA.—J. RICHARD, 25 Rue Mélingue, Paris, France. This invention provides an optical device applicable to stereoscopic cameras for the purpose of avoiding any disadvantages. By the application of this device the images formed on the negative are rectified and not inverted in either sense, so that the positive can be obtained directly from the negative without any transposition of the images being necessary.

METHOD OF PRODUCING MOUTHPIECES ON CIGARETTES.—L. H. SONDHEIM, care of Hotel Savoy, New York, N. Y. This improvement has reference to mouthpieces for cigarettes formed by treating the tobacco filling at one end with a binding substance, so that the tobacco is bound together or solidified to a degree to withstand the pressure of the teeth in the smoking of the cigarette.

CIGAR HOLDER.—E. E. TALIAFERRO and E. J. GOLDSWORTHY, Colorado Springs, Colo. The improvement is in holders of the character disclosed in former Letters Patent No. 954,000 granted to the above inventors, wherein a tubular finger-piece having a cigar-holding means is provided with a detachable ash catcher and holder adapted to envelop the body of the cigar. In the present patent the finger-piece is provided with integral means for holding the cigar and also for removably holding the ash catcher and holder.

MEANS FOR CARRYING SHIPS' LAUNCHES.—C. L. COUVETTE, deceased. V.

C. COUVERTIE, administrator, South Bend, Wash. This launch may be safely and quickly put into the water under any conditions, by constructing in the ship a water-tight compartment running thwartwise from side to side, which is provided at each end with doors forming the outer walls of the ship, which doors may be closed and hermetically seal the compartment, but on opening the door will permit the water to flow into the compartment so that the launch may then be water-borne therein and be floated out of the compartment into the sea.

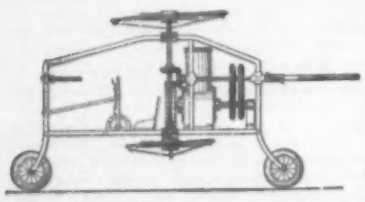
Hardware and Tools.

DOOR CHECK AND CLOSER.—J. G. LOFGREN, Norway, Mich. The invention pertains to devices for closing gates and the like, and the object is to provide a door check and closer arranged to readily close the door after being opened and released, to prevent slamming of the door, and to allow convenient attachment of the device to doors swinging either to the right or to the left.

LEVEL.—T. COUGHLIN, 1208 Clay Avenue, Bronx, New York, N. Y. The intention here is to provide a level member which may be readily secured in or moved from an opening in a frame member, means holding the member in any one of a plurality of positions relatively to the frame member, so that the device may be used as a level, a plumber for determining the inclination of a surface relatively to the horizontal. The level member is removable from the frame member to prevent its injury when not in use, and its casing portions may be opened to permit of access to the inclosed spirit member.

Machines and Mechanical Devices.

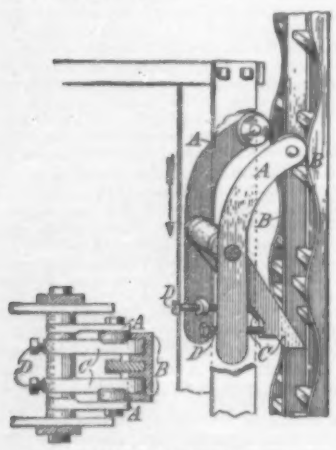
REVOLVING PLANE.—JAMES HAYTON, Box 358, Salt Lake City, Utah. This invention relates to revolving planes for flying machines, to take the place of the stationary planes now used therein. The revolving planes permit a more perfect supporting surface, and take up less space and have a higher factor of safety than the stationary supporting planes now in use in ordinary flying machines. The machine entire occupies only one-half as much space as other flying apparatus. It cuts its way



REVOLVING PLANE FOR FLYING MACHINE.

through the air by means of the revolving planes, and the weight of the device falling through the atmosphere makes the planes revolve and thus retards fast falling and keeps the machine in perfect balance while descending to the ground. The invention is shown in a side view in elevation in the accompanying engraving.

GOVERNOR SAFETY ELEVATOR CATCH.—VOLNEY W. MASON, Providence, R. I. The purpose of this improvement is to prevent the sudden fall of an elevator in the case of an accident, and is equally effective, no matter



GOVERNOR SAFETY ELEVATOR CATCH.

to what cause the increase of speed may be due, whether the breaking or flying off of the driving belt or the breaking of the hoisting rope. On each side of the elevator shaft or hatch way adjoining and forming a part of the elevator car guide, in the hatchway, is a vertical serpentine track, as shown in Fig. 1. Cross steps or rack teeth are placed within the elevated portions of the serpentine track. Firmly attached to the car on each side, and traveling with it, are governor safety catches, oscillating on a fixed stud attached to the car. The levers *A* carry rollers which engage the serpentine track *B* and cause the levers to oscillate with the vertical movement of the car, either up or down. At normal speeds, the dogs *C* will move with the levers *A* passing freely over all the stop bars. The relative adjustment of the dogs with the levers is effected by a pair of set screws *D*. Fig. 2 is a plan view from a point above the car, showing the position of the two outer levers *A* and the dogs *C* which follow in the serpentine track. In operation, at normal speed, the rollers of levers *A* are in continuous contact with the curve of the track *B*, while any undue increase of the speed causes the rollers to leave the curved track on a tangent, which brings the dogs *C* into engagement with the rack teeth, thereby checking and stopping the elevator. After the elevator has been stopped by the safety device, upon starting the elevator again, the catches automatically withdraw from the rack teeth.

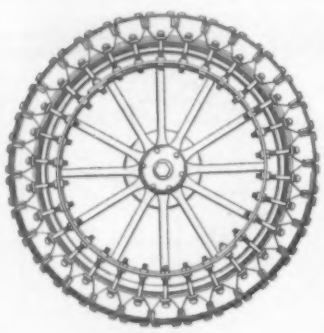
Pertaining to Vehicles.

TRACKLESS TROLLEY.—C. A. AHL, Salem, N. J. This invention as applied in practice is shown in the engraving. It relates to trolleys, the wheels of which do not run upon rails. Systems of this kind are used largely with omnibuses and similar vehicles for carrying street traffic. At a suitable point the roof of the car or omnibus is connected by a flexible trolley with an overhead trolley wire or wires, and on account of the flexibility

TRACKLESS TROLLEY.

of the trolley cord the vehicle can deviate from a course directly under the trolley wire without disconnecting the trolley shoe which runs upon the trolley wire. The object is to facilitate the exchange of the trolley poles of two vehicles which may meet. Thus the same effect is substantially obtained as though the shoes were arranged so that they could pass each other.

SHOE FOR TIRES.—C. A. WHYLAND, R. F. D. No. 1, Marion, Mass. Mr. Whyland's invention has reference to shoes for tires, and his object is to provide one consisting of a plurality of sections, disposed over the tread of a tire, and held against outward movement from the wheel by members which permit the



SHOE FOR TIRES.

sections to move inwardly, with the tire. The illustration shows a side elevation of a wheel, the tire of which is protected by the shoe. The shoes may be stamped out at very little expense, and the means provided for supporting them on the wheel may be readily and cheaply constructed, so that the complete device which affords the desired protection for the tire, as well as to prevent skidding, may be offered to the public at a relatively very low cost.

Designs.

DESIGN FOR A BADGE OR SIMILAR ARTICLE.—A. KOPETSCHNY, 42 Barclay Street, New York, N. Y. This ornamental design for a badge or similar article is of elongated form with graceful outlines. At the upper end four capital letters E D H S are placed in an oblique arrangement.

DESIGN FOR CARPET OR RUG.—W. E. SAYERS, care of G. S. Squire, Hartford Carpet Corp., 41 Union Square, New York, N. Y. The face view of this design shows a beautiful arrangement of flowered border and centerpiece. The rug is oblong in shape and has square corners. Mr. Sayers has designed another pattern of carpet or rug of oblong form and square corners with the border and centerpiece in strong contrast. This designer has also patented another carpet or rug whose length doubles the width, and of square corners. The border is very narrow, so that the scene, which represents a small child in a room with two dogs, a vase and a jardiniere of flowers, fills the design.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12597) C. G. asks: Please give me title and publisher of an astronomical almanac that contains the occultations (moon) and occultations, etc., of Jupiter's moons. Both of these are not given in the United States Government Almanac. A. We are at a loss to understand the requests made upon your postal of January 3rd. You ask for "an astronomical almanac giving the occultations of the moon," and the "occultations, etc., of Jupiter's moons." Our moon has no occultations. There is no heavenly body which can come between us and the moon to cover it from our sight. The phenomena of Jupiter's moons are given in full upon pages 487 to 512 of the *American Ephemeris* and *Nautical Almanac* for 1911, and are given in the issue for every year. We suppose this is what you refer to as the "United States Government Almanac." In these tables you will find the occultations designated by the letters "Oc." under the data for each month. We trust you will be able from this to find the data you require. We have not yet received our copy for 1912, but are sure it will supply the same matter as the copy for 1911 contains.

(12598) J. H. S. writes: With regard to query (12590) by C. A. H. in the January 13th, 1912, number of the SCIENTIFIC AMERICAN, respecting the distance a person would require to travel toward the sun before the earth would become invisible to the sight, I beg to say that I, some years ago, witnessed a transit of Venus, and plainly saw, with an opera glass, the disk of the planet against the sun. It appeared to me to be the size of an ordinary "buck-shot." Now, Funk & Wagnalls' Dictionary tells us that the diameter of the earth is 7,918 miles and that of Venus 7,700 miles, and the distance of the earth to Venus, when she is nearest to the earth, is 25.7 millions of miles, so that the 27 millions of miles found by calculation must be somewhere near the point where the invisibility of the disk of the earth would take place. I submit also that it goes without saying that the light reflected from the earth would be seen many times this distance. A. You are quite right in your remarks about the visibility of the earth's disk. The writer of this note saw the transit of Venus on December 6th, 1882, as you did. The planet was just visible with a smoked glass by the eye as a black point on the bright surface of the sun. It subtended a minute of arc, the smallest disk which can be seen without a telescope. You are also correct in saying that the light of the sun reflected by the earth can be seen much farther than the disk of the earth can, how much farther we have no means of determining as yet. Any planet ceases to show an appreciable disk at 3,438 times its diameter, which gives a little more than 27 millions of miles.

(12599) L. L. L. asks: How far will an object sink in the deepest known ocean, and how heavy would the weight have to be? Would shape of sinker be any advantage? Is it possible at the present time to make a cable that would stand the strain necessary to lower said weight to the bottom, including the weight of cable? How deep has the ocean been sounded? Can you refer me to any one of your special numbers pertaining to sounding, etc.? How is it done, and so on? I have noticed in both the *Technical World* and the *Popular Mechanics* a description of Tesla's new rotary disk turbine propelled by either steam, air or water. Would like to have you give me a full description of this machine in your valuable paper in the near future. A. A body which sinks in water at the surface will continue to sink till it rests upon the bottom of the deepest known ocean, without reference to its shape or size. The ocean has been sounded to the bottom in all places where soundings have been attempted, and it is believed that the deepest places are known. The sinkers are not drawn up again. A piano wire is used to lower the sinkers, or rather the sinkers draw the wire down so as to know the depth reached by the sinker, which is then detached and left, while the rod on the wire brings up mud from the bottom. An iron ball is often used as a sinker. The deepest place found in the ocean is in the South Pacific, off the Fiji Islands, where the sounding ball went down 30,930 feet. Your question as to sinking a body to the bottom of the ocean has often been answered in our columns. You will find it fully discussed in the SCIENTIFIC AMERICAN, Vol. 104, No. 25, and Vol. 105, No. 9, price ten cents each. The two together give a full treatment of the topic. The Tesla motor is described and illustrated in SCIENTIFIC AMERICAN No. 14, Vol. 105.

INQUIRY COLUMN

Inquiry No. 9247.—Wanted, to buy a Parmelee aerated water.

Inquiry No. 9254.—Wanted, the name and address of manufacturers of lead pencils and pen holders, such as are used for printing advertisements on.

Inquiry No. 9255.—Wanted, to buy a patent roller, a ball-bearing axle, which could be purchased on a royalty basis; it must be cheap and fully proved.

Inquiry No. 9256. Wanted addresses of parties having Pitchblende deposits, if able to ship ore.

Inquiry No. 9257. Wanted addresses of firms selling second-hand water turbines.

Inquiry No. 9258.—Wanted addresses of parties having gem materials to offer in any part of the world.

Inquiry No. 9259.—Wanted to buy a machine for removing the coating of a filbert.

Inquiry No. 9260.—Want addresses of parties able to ship corundum, garnet, flint, emery or any material suitable as an abrasive.

Inquiry No. 9261.—Wanted, a manufacturer to make card games.

Inquiry No. 9262.—Wanted, to buy a glass which is a conductor of electricity, and the address of the makers of the same.

Across the Atlantic by Aeroplane

(*Concluded from page 106*)

treme views as to the type of machine best fitted to make the attempt. Some believe that extraordinary speed should be the chief consideration in the design since a speedy machine would lessen the time of transit and require less fuel on that account. Others believe that a slow, large-surface machine would be more reliable, since it would carry more weight per horse-power than the faster design. The writer believes that a happy mean of the opposed extremes will best subserve the end in view; that is, the machine should be sufficiently engined relatively to its resistance, so that a speed of fifty miles per hour will be insured in order to afford control in gusty winds. This speed is possible, together with a surface adequate to carry a very heavy load efficiently. In other words, if you increase an aeroplane's speed beyond sixty miles per hour, the resistance increases in such rapid proportion that weight has to be added to the aeroplane in greater proportion for long voyages, and in several directions, i. e., the greatly increased horse-power required in order to overcome the increased resistance due to the increase of speed requires extra weight in engine and fuel. The parts of the machine also should be heavier in order to stand the increased strains. On the other hand, a large-surface machine may be relatively inefficient by reason of its slowness and very dangerous by reason of sluggishness in control.

A machine of the general design shown in the illustration could have a span of one hundred feet and a chord of ten feet, could be propelled by five fifty-horse-power Gnome engines geared down to two tractor screws, could travel at fifty miles per hour, and carry 7,500 pounds of weight, 4,500 pounds of which would be a "useful load." This would allow the weight of two operators and one mechanician and sufficient oil and fuel to sustain the aeroplane at fifty miles per hour for thirty-six hours, or over a course of 1,800 miles in still air. Five fifty-horse-power Gnome engines could be fitted and all used at the same time to attain altitude with a full load. The fifth engine could be stopped by throwing it out of gear with a friction-disk clutch, and four engines would sustain the weight of the machine until sufficient of the fuel load had been consumed to lessen the angle of incidence and decrease the head resistance, when another engine could be stopped. In this way the power would not be wasted and every drop of fuel could be made to count for the end of the voyage. It might even be possible to sustain the machine with only two engines going after most of the fuel was consumed and if the aeroplane was at sufficient altitude to afford a slight assistance by gravity.

The sketch shows a portion of the fuselage inclosed and directly under the center of pressure, where sufficient oil and fuel could be stored in suitable tanks, so arranged as to leave a two-foot passage fore and aft from the cabin, just under the operator's cockpit to the engine room. The extreme width of the fuselage is eight feet, and affords six feet clear head room. The engines are placed on both sides of the inclosed central passage so that the mechanician would find each engine very accessible. Hence the engines will always be working in free air. The transmission could lead to a central shaft and thence by incased patent chain to the shafts of the two tractor screws. The friction clutch would enable the mechanician to throw any engine in or out of operation at will, so that the cleaning of the valves and spark plugs should be as simple a matter during the passage as it would be at rest. If anything special went wrong with an engine the mechanic could have the help of the operator "off watch," but as a matter of fact those of us who have used Gnome engines under the care of expert mechanicians know that a 36-hour run for a fifty-horse-power Gnome engine clean and in otherwise good condition is no occasion for the least worry. I should really be surprised if with five engines it were necessary to clean one valve or one spark plug in the entire trip. In a machine so large as the one illustrated the passage fore and aft of the mechanician would hardly be perceptible to the control of the operator.

The resistance of such a machine should be quite low, since it has inclosed streamline form throughout and since the single row of struts in the center of pressure of the planes greatly reduces the wire and strut resistance common to most biplanes.

The aspect ratio is excellent, and the chord is not so deep that one need fear loss of square area lifting efficiency.

The controls of the aeroplane, although large, are all of the balanced type, so that there need be no concern as to the operator's ability to work them freely in gusty winds.

The writer until recently favored with Mr. Glenn Curtiss the use of a central boat or float, but he is now converted to the two-float type and believes that either of these floats would make first-class lifeboats in case of emergency and that the superstructure of the hydro-aeroplane should be readily detachable from the float. The lines of the floats should be for strength, lightness and speed; the flat-bottomed hydro-plane principle being superfluous where you have an aeroplane to lift your floats clear of the water.

If it became necessary to alight on the water in mid-ocean this could be accomplished in comparatively smooth water without extreme risk, and unless the seas were new and short the aeroplane could get into the air again with little difficulty.

It is practically certain that were an aeroplane of the type described to remain in the air for thirty hours pointed in the right direction and having an altitude of about 5,000 feet, the air passage of the North Atlantic Ocean would be accomplished. A height of 5,000 feet would furnish an atmosphere comparatively free from the gusty surface winds and clear of all fog, so that with a polaris instrument and a special azimuth table one would not need to depend on the compass for direction. The height would also give one an extended horizon (80 miles at 4,900 feet), so that there would hardly be a period on the passage over the steamship route to Europe when some vessel would not be within the 160-mile range of vision. Noting the direction of the vessel's course would also be a check on the navigator's other methods of finding direction.

Of course the large size of the aeroplane would make it conspicuous at 5,000 feet, and the steamers could report the aeroplane's progress and position by wireless.

A glance at a pilot chart for the North Atlantic Ocean during July and August will show there is a very dependable westerly movement of the upper air currents, and it is safe to rely upon a considerable increase of the aeroplane's speed over the North Atlantic course due solely to the wind currents.

A moonlight period could be selected for the trip, and the start made from St. Johns at daybreak.

On the whole one may reasonably conclude that the transatlantic aerial voyage by heavier-than-air machines is well worth considering, and we may wish success to the chairman of the Royal Aero Club, Roger K. Wallace, in his efforts to secure a £20,000 prize for the first aerial connection of England and America.

Savage Irrigation in Luzon

(*Concluded from page 108*)

deflected from mountain streams or arising from springs passes through decomposed vegetable matters, ashes, black alluvial soil, and manure, and is then conducted to the topmost rice terrace, carrying in suspension rich fertilizing matter which is evenly distributed. There is thus no part of a rice paddy which is not fertilized. From the topmost terrace the water flows through a gap in the retaining wall to the terrace next below, still carrying fertilizing matter in suspension. Most of the work in the paddies is done by the women, who wade about stirring up the sediment. Sometimes the rice straw of a harvested crop is covered over with dirt and allowed to rot. The result produces the finest rice raised in the Philippines, of great size, and, it is claimed by experts, of practically perfect form. Ranchers in the west occasionally run an irrigating ditch through fertilizing matter, but the practice is not general.

Labor on the retaining walls is done

by the Ifugao warriors, who place the stones gathered in the ravine beds one above another somewhat in the fashion that a New England farmer builds a stone fence. They are provided with wooden spades, knives and spears, which they use as occasion requires. These implements are forged by themselves or else gained by trade from the Benguet Igorrotes. In some places they have carved down the rock which appears to be a sandstone or decomposed granite. One of the accompanying panorama pictures shows an isolated hill in the middle of the marvelous canyon referred to, carved into terrace form and surrounded by terraces on all sides. At the summit of the hill is seen an Ifugao settlement commanding a baronial view of the country. This pyramid rises probably eight hundred feet above the stream in the gorge below. The Singer Building in New York, if set in the gorge, would be practically lost to view. It would seem tiny in comparison with the work of the head-hunters, for the mountains are so sculptured that in places they seem almost to have been built up by artificial means.

The gorge here shown is densely cultivated throughout its entire length. Every ravine leading into it shows a succession of innumerable terraces. Until a few years ago each Ifugao settlement was in a state of feud with its neighbor. Settlements as close as two miles from one another were hostile. For generations the warriors of Quiangan and Banaue had engaged in raiding the opposing villages for heads. It is said that early in the last century the Spanish governor-general of the Philippines sent a detachment of troops to subdue these hillsmen, but that the soldiers were decimated by the head-hunters, who lay behind their retaining walls and threw showers of spears at the invaders as they marched through the country in single file. Last year, according to Philippine Commissioner Worcester's report, there was no head taking reported among the 170,000 Ifugaos.

The photographs here shown were taken by the writer in an overland trip through Luzon between Manila and its northernmost port, Aparri. The railroad is left at Dagupan, the terminus of the Manila and Dagupan Railway, and thence the journey proceeds inland. Contrary to general opinion, the journey through the Cordillera Mountains is not hard or dangerous. It is filled with unique interest every moment and if made well in advance of the rainy season the streams are easily forded.

The Heavens in February

(*Concluded from page 110*)

surface can be calculated—or, at least, a value can be obtained which is probably not far from the truth. In this way Welsing and Scheiner of Potsdam have calculated that the surface temperature of stars which resemble Sirius in spectrum is, on the average, about 10,000 deg. Cent. (The Sun's surface temperature is about 6,000 degrees, that of the electric arc a little under 4,000 degrees, and the hottest ordinary furnaces hardly reach 2,000 degrees.)

If this is true of Sirius, its surface would give out about eight times as much light per square mile as the Sun's does. As the total light of Sirius is twenty-four times that of the Sun, it would have three times the Sun's superficial area, and hence about one and three-quarters times the Sun's diameter. This would make its bulk about five times that of the Sun, and its density about half as great.

To get similar data for the faint companion is more difficult, as its spectrum cannot be observed, owing to diffused light from its brilliant neighbor. We may, however, make a rough guess as follows:

The companion of Sirius is almost equal to the Sun in mass. It is almost certainly not more than fifteen times as dense as the Sun (for this would make it denser than platinum) and probably not more than ten times as dense. On the latter hypothesis, its surface would be about one-fifth that of the Sun. But it gives out only $\frac{1}{100}$ as much light as the Sun, and hence must emit only $\frac{1}{20}$ as much light per square mile. According to physical theory, this would demand a temperature of about 3,000 degrees.

If on the other hand we assume that the companion equals the Sun in density

The Science of Handling Men

¶ Fritz Hampelmann was a Berlin paper hanger out of a job. Did he read "Help Wanted" advertisements in the Berlin newspapers, and tramp about hour after hour in search of a job? Not much. Fritz went to the Municipal Labor Bureau of Berlin, gave his name and address, and informed the official in charge that he wanted a job. Then he went home.

¶ Herr Johann Fensterlein, also of Berlin, was an interior decorator who needed a paper hanger. Did he read the "Situations Wanted" column in the Berlin newspapers? Not much. Herr Fensterlein went to the Municipal Labor Bureau in Berlin, gave his name and address, and told the official in charge that he wanted a paper hanger.

¶ And so it came about that Fritz Hampelmann and Herr Fensterlein were made acquainted with each other.

¶ This is only one phase of the German science of handling men—one short chapter in the intensely interesting story of the manner in which Germany is endeavoring scientifically to settle the eternal conflict of capital and labor.

¶ Not only does the Government (Imperial or Municipal) bring employer and employee together, to their mutual advantage, but it sees to it that a man is treated at least as well as a machine. The great manufacturing corporations not only comply with the Government regulations, but even go far beyond them, in caring for the men whom they employ. Is a laborer sick or incapacitated by accident? Part of his salary is paid and he is given the best medical care at the expense of his employer. Is the laborer too old to work? He receives a pension that places him beyond care.

¶ All this pays in marks and pfennigs. It pays to give a workman a decent, well-designed house in which to live, at a low rental, because he can work without worrying where next month's rent is coming from. It pays to give him his midday meal for less than cost, for the same reason that it pays to shovel good and not bad coal under a boiler.

¶ Ultimately the consumer pays for it all. And why shouldn't he? If he pays for the wear and tear of machinery and material, why shouldn't he pay for the wear and tear of humanity? All these things will be considered in an article by Mr. Waldemar Kaempffert, Managing Editor of the "Scientific American," in a coming number of the "Scientific American," the third of a series in which he will set forth the impressions gathered from a visit to the biggest European works and from interviews with the biggest corporation directors. In that article it will be shown that there is a science of handling men; and that the friction in the human machinery of industry, while it cannot be utterly eliminated, can at least be sensibly reduced.

SEE ISSUE OF FEBRUARY TENTH

(which is probably in error the other way) we get its surface brightness $\frac{1}{10}$ that of the Sun, and its surface temperature about 2,400 degrees. The actual values probably lie between these limits.

The companion of Sirius, therefore, although relatively dar and cold when compared with its primary, or even with the Sun, is far from being so, when judged by terrestrial standards.

The range of temperature just estimated lies above that attained by most ordinary commercial sources of light, except the arc light and the tungsten lamp, and is fully equal to the working temperature of the latter. This star, therefore, though faint and cold among its stellar neighbors, is probably as hot and bright all over its millions of square miles of surface, as is the filament of a tungsten lamp, which is so conspicuous for its almost dazzling brightness, when compared with most other familiar illuminants.

The other constellations may be very easily found with the aid of our map. Orion and Gemini are in the southwest, the latter high up. Taurus, Auriga, and Perseus are conspicuous in the western sky, with Aries and Andromeda near the horizon below them. Cassiopeia and Cepheus are low in the northwest, and Draco and Ursa Minor in the northeast. Ursa Major and Leo are high in the northeast and east, and Boötes and Virgo are rising below them. More than half of Hydra has now risen above the southeastern horizon, and the monster's head extends nearly to Cancer and Canis Minor. The latter is high on the meridian, with Canis Major below on the left and Argo on the southern horizon.

The Planets

Mercury is a morning star all through February, but is visible only in the earlier part of the month, and then under unfavorable circumstances, rising less than an hour before the Sun. Venus is likewise a morning star, rising a little after 5 A. M. in the middle of the month, and fairly conspicuous. On the 24th she is in conjunction with Uranus, the latter being 40 minutes south of his brilliant neighbor. If the planet were only visible in the evening instead of the morning this would be a good chance to identify Uranus with a field glass.

Mars is in Taurus, moving eastward from near the Pleiades to a point northeast of Aldebaran, and is visible from dark till after midnight. Though still decreasing rapidly in brightness, he still appears brighter than Aldebaran, which he so much resembles in color.

Jupiter is a morning star in Scorpio, rising about 2:30 A. M. on the 15th, and observable before dawn, though too far south, and hence too low in the sky, for the best atmospheric conditions. Saturn is in quadrature with the Sun on the 3d, and thereafter is an evening star, but, being north of the equator, he remains in sight until after midnight during the early part of the month, setting about 12:50 A. M. on the first, and 10:50 P. M. on the 29th.

Uranus is a morning star in Capricornus, and can be best identified at the time of his conjunction with Venus on the 24th. Neptune is in Gemini, in R. A. 7 hours, 34 minutes, 13 seconds. Declination + 21 degrees, 6 minutes, 12 seconds on the 1st, and 7 hours, 31 minutes, 35 seconds, + 21 degrees, 12 minutes, 40 seconds on the 29th. He appears as a star of the eighth magnitude, and can be identified by his motion.

The Moon is full at 6 P. M. on the 2d, in her last quarter at 7 P. M. on the 9th, new near midnight on the 17th, and in her first quarter at 1 P. M. on the 25th. She is nearest us on the 1st, and farthest away on the 14th. In her course around the heavens she passes near Neptune on the 1st, Jupiter on the 11th, Venus on the 14th, Uranus on the 15th, Mercury on the 16th, Saturn on the 24th, Mars at 10 P. M. on the 25th, and Neptune again on the 28th. The conjunction with Mars is fairly close.

Princeton University Observatory.

New Uses of Vanadium

VANADIUM steel is now used for rock drills, both for the drill itself, as well as in the castings for the cylinder chest and air head. Vanadium steel is also used for twist drills, for the cast-iron piston rings of a very well-known agricultural oil engine tractor,

for the steel shafting of blooming mills, for the steel tires of consolidation locomotive engines, for coil springs, and for punches and dies.

Vanadium alloys more readily with aluminium and in larger percentages than with copper. Alumino-vanadium containing about 10 per cent vanadium has been considerably used in non-ferrous metals, and increases their tensile strength, elastic limit and textural qualities.

NEW BOOKS, ETC.

THE COMPLEAT ANGLER, OR THE CONTEMPLATIVE MAN'S RECREATION. Being a Discourse on Fish and Fishing Not Unworthy of the Perusal of Most Anglers. By Izaak Walton. With illustrations by James Thorpe. New York and London: Hodder & Stoughton, 1911. Quarto; 167 pp. Price, $5.

Of editions of Izaak Walton there are no end, one of the most satisfactory being that edited by Richard Le Gallienne. But the present edition, which has been edited by R. D. Marston, has the advantage of Mr. Thorpe's extremely beautiful and faithful color drawings, which are beautifully reproduced and mounted on a dark green card, which shows them off to excellent advantage. Some of the old English interiors, particularly the inn scene, are most graphic. The book itself is a portly one, and is beautifully printed and bound. The paper used is particularly to be commended; also the end papers, which show our dear old angler on the way to the banks of the Chess. The illustration of fish on the tissues is also a clever idea. It is one of the best pieces of book making that we have seen in a very long time. This edition is specially to be commended to all those who are fond of this rare old sportsman.

SOYER'S PAPER BAG COOKERY. By Nicholas Soyer. New York: Sturgis & Walton Company, 1911. 16mo.; 130 pp. Price, 60 cents net.

Cooking in paper is by no means a new idea, but M. Soyer deserves great credit for broadening, simplifying, perfecting, and popularizing the process. This is distinctly an American edition, not merely by virtue of publication here, but because it speaks in American terms, values, and quantities, and includes most of the dishes familiar to the American palate. The recipes are not extravagant, and give, among other things, a week's dinners for the workingman's home. Aside from his practical knowledge, M. Soyer is a very entertaining writer. His introduction makes a strong plea on behalf of the cleanliness, economy, and the resultant flavor of his method, and does not hesitate to state its limitations. So far, the experiments with soup, omelette, beans, cabbage, and macaroni have proved comparative failures. With most other things, however, almost ideal results have been obtained; in addition to the advantages cited above, the objectionable smell of cooking is entirely done away with; it is hardly possible to burn foods in this manner of preparing them; and the nutritive values are conserved to a remarkable degree.

THE STORY-LIFE OF WASHINGTON. A Life History in Five Hundred True Stories, Selected from Original Sources and Fitted Together in Order. By Wayne Whipple. Philadelphia: John C. Winston Company, 1911. 12mo.; two volumes. 345 plus 364 pp. Price, $3.

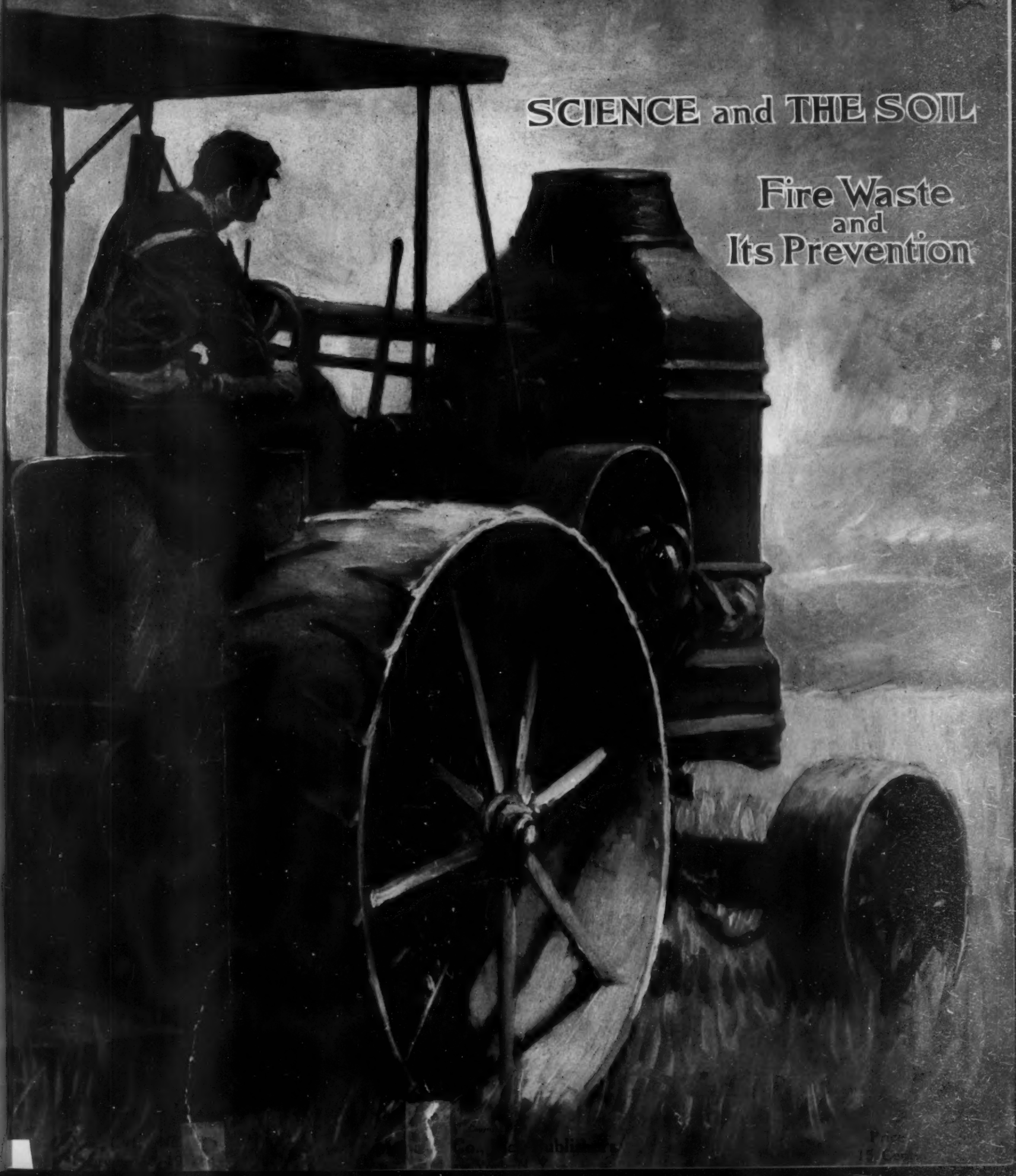
Nearly every recent biographer has announced that he was now taking down the wooden image called Washington from its high pedestal and reviving it, somewhat as the statue of Galatea became a living woman before the astonished gaze of Pygmalion the sculptor. All these necessities have been going on for a generation, and several of the so-called "true" Washingtons bear hardly a family resemblance to one another, so it is reasonable to infer that some of them, at least, have little likeness to the great original. It was the intention of the author to avail himself of hundreds of anecdotes, illustrations, etc., and focus them together like a composite photograph, or rather from all sides and angles of view, making a solid, living, moving picture of George Washington and his wonderful career. The idea is a very excellent one, and the work appears to have been done conscientiously. All of the various stories, etc., are credited to the original sources.

DES INGENIEURS TASCHENBUCH. Herausgegeben vom Akademischen Verein Hütte, E.V. Vol. I—II. Berlin: Wilhelm Ernst & Son, 1911. 12mo.; illustrated.

Each volume of this engineers' handbook contains upward of 1,000 pages of highly condensed instructions and reference material. Vol. 1 covers the mathematics and mechanics of the subject, with tables of powers, roots, etc., and with illustrated demonstrations of principles. Vol. 2 takes up specific devices, engines, and machinery—windmills; steam engines and boilers; pumps; water-wheels; meters, gages and indicators; power hammers, presses, and riveters; transmission gear; traveling cranes; and elevating and conveying machinery.

SIXTY-EIGHTH YEAR

SCIENTIFIC AMERICAN

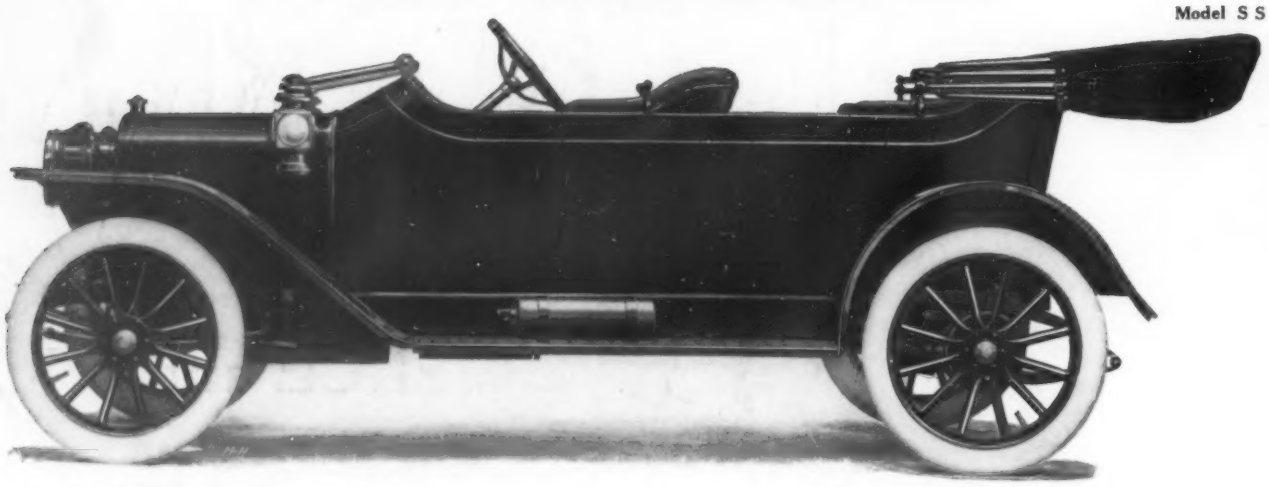


SCIENCE and THE SOIL

Fire Waste and Its Prevention

The First Touring Car Under $1000 With Self-Starter

Model S S



R-C-H "Twenty-Five" 5-Passenger Touring Car

110-inch Wheel Base

$950
F. O. B. Detroit

Equipped with **self-starter** 32 x 3½ tires, dual ignition, demountable and quick-detachable rims, gas tank, extra rim, top, windshield, 5 lamps, horn, tools, and tire repair kit, **long stroke motor, 3 speeds, enclosed valves, magneto.**

ANY manufacturer can claim that his car is the best on the market for the money—most manufacturers do. In considering the R-C-H, let's put the judgment up to you for a change. You read motor-car announcements day after day—have you ever seen a value approaching this?

If we took every price-mark from this page, leaving merely the equipment details and specifications; if you had to fix the price of the R-C-H by comparison with any previous standard of car value—you'd say $2000—or more. And when we tell you that no $5000 car could be better built—that $2000 will not buy you as great value anywhere else, **we want you to challenge these statements.** For we can't tell you about the R-C-H in a magazine page—you've got to see and test the car for yourself in order to realize its extraordinary value.

Some Construction Features of the R-C-H

Just a few are all we've space for. We use 123 drop forgings—more than in any other car in the world, irrespective of price. This means much greater strength and durability as compared with castings. It means, too, a much more perfect interchangeability of parts, because drop forgings permit an absolute accuracy of machining impossible with castings. And we think that every part of the R-C-H is more readily accessible than in any other car at any price.

The motor is the first adaptation in this country of the long stroke idea so successful abroad. And the motor is really long stroke (3¾ x 5) with just the proper relation of stroke to bore that the best engineering practice has demonstrated to be most economical and efficient. It should be borne in mind that merely making the stroke of a motor long and widening the bore correspondingly does not achieve the much-desired long-stroke effect.

The drive is left side, the only sensible drive for American road rules, and the control is center lever, out of the way, yet most convenient to the operator, and at his right hand. Come and see the car, and judge it for yourself—that's all we ask.

Standard Models

Regular equipment of top, windshield, lamps, generator, horn, tools and kit, without self-starter and other special equipment quoted above.

5-Passenger Touring Car	**$850**
Touring Roadster	**800**
Roadster	**700**
(Equipped for 4 Passengers)	**750**
Colonial Coupe	**1050**

Canadian Prices

These are as follows, f. o. b. Windsor, duty paid: **S.S. Models**—Touring Car, $1175; Touring Roadster, $1125; Roadster, $975; Roadster, 4-passenger, $1050; Coupe, $1425. **Standard Models**—Touring Car, $1050; Touring Roadster, $1000; Roadster, $850; Roadster, 4-passenger, $925; Coupe, $1300.

Specifications

Motor—4 cylinders, cast en bloc—3¼ inch bore, 5 inch stroke. Two-bearing crank shaft. Timing gears and valves enclosed. Three-point suspension. **Drive—left side.** Irreversible worm gear. 16 inch wheel. **Control—Center lever** operated though H plate, integral with universal joint housing just below. **Springs**—Front, semi-elliptic; rear, full elliptic and mounted on swivel seats. **Frame**—Pressed steel channel. **Axles**—Front, I-Beam, drop-forged; rear, semi-floating type. **Body**—English type, extra wide front seats. **Wheel Base**—110 inches. Full equipment quoted above.

WRITE FOR BOOKLET. Descriptive folder sent free on request. But see the car itself—that's the only way to judge it.

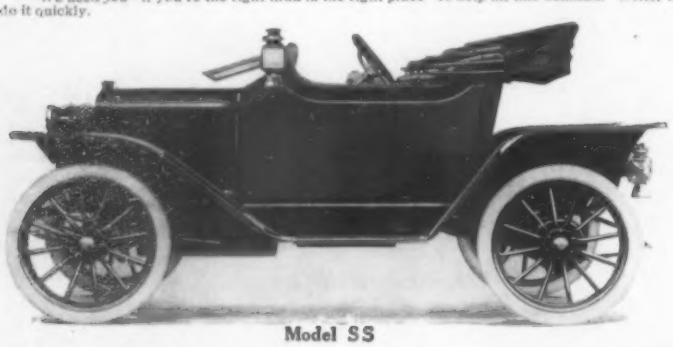
R. C. HUPP, Manufacturer, 132 Lycaste Street, Detroit, Mich.

DISTINCT FROM AND HAVING NO CONNECTION WITH THE HUPP MOTOR CAR COMPANY

BRANCHES: **Boston, 563 Boylston St.; Buffalo, 1225 Main St.; Cleveland, 2122 Euclid Ave.; Chicago, 2021 Michigan Ave.; Denver, 1620 Broadway. Detroit, Woodward and Warren Aves.; Kansas City, 3501 Main St.; Los Angeles, 1242 Flower St.; Minneapolis, 1206 Hennepin Ave.; New York, 1989 Broadway; Philadelphia, 330 N. Broad St.; Atlanta, 548 Peachtree St.**

DEALERS: We have already under way an advertising campaign on the R-C-H which will reach every nook and corner of the country. Color pages and spreads in such national mediums as *The Saturday Evening Post*, Collier's, Life, Leslie's, Literary Digest, Scientific American, and others are being used. The same thing is being done in trade papers. And large display space in local newspapers everywhere completes the campaign. We have hundreds of dealers now—we have room for many more. The public response to the R-C-H announcements is tremendous and country-wide.

We need *you*—if you're the right man in the right place—to help fill this demand. Write, wire, phone or call—but do it quickly.



Model SS

$800 **F. O. B. Detroit**

R-C-H "Twenty-Five" English Body Roadster

Equipped with self-starter, 32x3½ tires, dual ignition, demountable and quick-detachable rims, gas tank, extra rim, top, windshield, 5 lamps, horn, tools and tire repair kit—long stroke motor—3 speeds—enclosed valves—magneto. **Touring Roadster,** same equipment, $900. Extra large gasoline and oil capacity. Wheel-base of roadsters, 86 inches—other specifications same as touring car.

Model SS

$1150 **F. O. B. Detroit**

R-C-H "Twenty-Five" Colonial Coupe

SPECIFICATIONS—Enclosed body; drop seat for third person; 100 ampere hour lighting battery. Full equipment including 2 electric lamps, combination electric and oil side and tail lamps. Other specifications and complete equipment same as roadster. In no closed car at any price will you get greater comfort, service and beauty than this.

Tire Cost—Where It Goes

23% is Due to Rim-Cutting—
25% is Due to Overloading

We sent out men to look at thousands of ruined clincher tires.

And 23 per cent of all those tires were rim-cut.

Sometimes this ruin is the driver's fault. He runs the tire partly deflated.

It is usually due to a puncture.

A clincher tire which goes flat may be wrecked in a moment—ruined beyond repair.

On the other side, note this:

No-Rim-Cut tires are more widely used than any other make of tire.

Men know they can't rim-cut, so they get more abuse—more under-inflation—than any other tire that's made.

But, despite all this neglect, we have never had an instance of rim-cutting in all the hundreds of thousands used.

Most tires are overloaded.

Not through any fault of the motor car maker. He equips for expected load.

But you add heavy extras.

And some of your passengers sometimes overweigh the expected 150 lbs.

The result is a blow-out.

That's why we make No-Rim-Cut tires 10 per cent over the rated size. The manner of fitting permits that.

That means 10 per cent more air—

Ten per cent more carrying capacity.

And that, with the average car, adds 25 per cent to the tire mileage.

Yet these tires which can't rim-cut—these oversize tires—now cost no more than other standard tires. That's why they outsell others.

Average Saving, $20 Per Tire

These two features together—No-Rim-Cut and oversize—under average conditions double the life of a tire. This judgment is based on 13 years of experience, with 800,000 Goodyear tires.

If that is so, this single invention is saving an average of $20 per tire, figuring various sizes. On our output this year that will mean $10,000,000.

Those figures, of course, are only approximate. One can't be exact on the cost of tire upkeep.

Proper care and inflation, roads, speed, loads, etc., all affect tire mileage.

But the figures are fair.

Certain it is that No-Rim-Cut tires save all the ruin of rim-cutting.

Certain it is that their 10 per cent over-size adds an average of 25 per cent to the tire mileage.

No Extra Cost

These patented tires, when first brought out, cost one-fifth more than other standard tires.

Now they cost an equal price. Our multiplied output has cut the cost of production.

Note what that means.

No-Rim-Cut tires, 10 per cent oversize, cost just the same as old-type clincher tires. The saving is entirely clear.

You get all their advantages by simply insisting on Goodyear No-Rim-Cut tires.

By Far the Leading Tire

Now note the judgment of users.

The demand for these tires has doubled over and over. It now exceeds the demand for any other type of tire.

Last year's sales on No-Rim-Cut tires exceeded the previous 12 years put together.

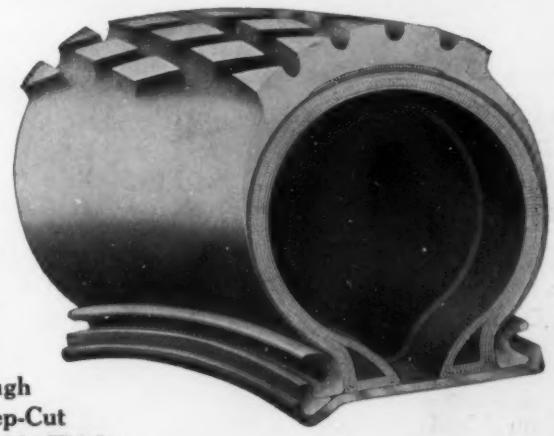
This year, 127 leading motor car makers have contracted for Goodyear tires.

That's the result of experience.

These tires have been tested by not less than 100,000 users. And that is the result of the testing.

Isn't that evidence enough?

THE NEW GOODYEAR NON-SKID TREAD



Tough
Deep-Cut
Double-Thick

GOODYEAR

No-Rim-Cut Tires

With or Without Non-Skid Treads

Non-Skid Treads, if Wanted

Now, these tires, if you want it, come equipped with an ideal Non-Skid tread.

Not any short-lived protection. Not a mere corrugation in a regular tread.

This is an extra tread, vulcanized onto the regular, so it gives you a double-thick tread.

This extra tread is of very tough rubber. And its thickness permits these deep-cut, enduring blocks.

The road surface is grasped by countless edges and angles—grasped with a bulldog grip.

Each block widens out at the base, so the strain is distributed the same as on smooth-tread tires.

One moment's comparison reveals a dozen advantages over any other non-skid invention. We have worked for three years to perfect it.

The Final Tire

The tire of the future, beyond any question, will be this No-Rim-Cut type.

The old-type clincher—the hooked-base tire—is being displaced on thousands of cars each month.

After 13 years of tire making we consider this tire the best that we ever can make.

It is so close to perfection that our liberal warrant now costs us but a trifle per tire.

Rubber never can be made more impervious to wear. Fabric can never be made more enduring.

This type and this tire, in our estimation, represents finality in tires.

Our new Tire Book is ready. It is filled with facts, based on 13 years of tire making, which every tire user should know. Ask us to mail it to you.

THE GOODYEAR TIRE & RUBBER COMPANY, AKRON, OHIO

Branches and Agencies in 103 Principal Cities
Main Canadian Office, Toronto, Ont.

We Make All Kinds of Rubber Tires, Tire Accessories and Repair Outfits
Canadian Factory, Bowmanville, Ont.

(465) (465)